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# Stormwater Management Plan

Deer Run Subarea A and B

City of Dublin, Ohio

A large, abstract graphic composed of several overlapping, semi-transparent orange polygons. The shapes are arranged to create a sense of depth and movement, resembling a stylized, modern architectural structure or a series of interlocking planes. The colors range from a light, pale orange to a deeper, more saturated orange.

January 2016

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## Stormwater Management Plan

Deer Run  
Subarea A and B

City of Dublin, Ohio

Prepared By:

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I hereby certify that the calculation contained herein are accurate to the best of my knowledge and belief.

  
Angela C. Fedak, P.E.



01-04-2016  
Date

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## I. Project Summary

Project Name: Deer Run Subarea A and B

Location: Dublin, Ohio

Type: Stormwater Management Plan

Reviewing Agency: City of Dublin

### Hydrological Analysis Method:

This report uses the unit hydrograph method described in the National Engineering Handbook (NEH) using the Natural Resources Conservation Service (NRCS) Type II 24-hr design storm. Requirements for the post construction quantity/quality control are per the City of Dublin Stormwater Management Design Manual, June 2013. Post construction quality control shall be designed according to the Ohio EPA General Permit Authorization for Storm Water Discharges Associated with Construction Activity Under the National Pollutant Discharge Elimination System (NPDES). HydroCAD Version 10.00 was the design software used for the analysis.

Rainfall data used (per the City of Dublin Stormwater Management Design Manual):

Rainfall Depths						
1-yr	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
2.20 in.	2.63 in.	3.24 in.	3.74 in.	4.44 in.	5.02 in.	5.63 in.

### Proposed Design Overview:

Water Quantity: Not Applicable per the City of Dublin Stormwater Management Design Manual, Chapter 2, Section 2.A.1.a

Water Quality: Bioretention Swale

Receiving Body of Water: Subarea A – Scioto River  
Subarea B – Deer Run



## **II. Introduction**

The design and analysis described within the contents of this Stormwater Management Report is for the construction project of Deer Run Road Subareas A and B in which private roads are being constructed to provide access to proposed estate lots located in this area. The overall project construction consists of two subareas, Subarea A and Subarea B. The overall development area for Subarea A is 18.5 acres and the overall development areas for Subarea B is 16.1 acres that will allow for the development of 7 total estate lots. The Deer Run Subarea A and B project development consists of the construction of the roadway to provide access to these proposed estate lots, still yet to be designed and developed. In Subarea A, the roadway construction consists of 0.69 acres of the overall 18.5 acres (1.87 acres are still available for estate development). In Subarea B, the roadway construction consists of 1.19 acres of the overall 16.1 acres (4.07 acres is still available for proposed estate lots development). The project is located off of Dublin Rd on the existing Deer Run Rd. with Subarea A located north of Deer Run and Subarea B located south of Deer Run. The intent of the project is to develop the existing wooded areas into several proposed estate lots for residential use.

The runoff from the roadway will be collected in a Bioretention swale to address quality requirements. In Subarea A, the water is collected in the bioretention swale and outlets to the Scioto River. In Subarea B, the runoff is collected in a bioretention swale and outlets to Deer Run.

## **III. Hydrologic Analysis Method**

The design and analysis of the stormwater plan were completed using the unit hydrograph method described in the National Engineering Handbook (NEH) using the Natural Resources Conservation Service (NRCS) Type II 24-hr design storm. From the NRCS tables provided, the runoff curve number was determined as well as the method of calculating the time of concentration. From this, the 1, 2, 5, 10, 25, 50, and 100-year storm discharges were calculated using the HydroCAD (Version 10.00) program.

## **IV. Pre Developed Conditions**

The overall pre-developed conditions for Subarea A consists of 18.5 acres to be rezoned. This land consists of wooded area with little to no ground cover. According to the United States Department of Agriculture (USDA) Soil Maps, this soil is Type "B" Soils (Milton silt loam, glymwood silt loam, and ground moraine) which corresponds to the runoff Curve Number 77. The time of concentration for the pre-developed area is 12.03 minutes.

The overall pre-developed condition for Subarea B consists of 16.1 acres to be rezoned. This land consists of wooded area with moderate ground cover in Type “D” Soils (Glynwood Clay Loam and End Moraine) which corresponds to the runoff Curve Number 83. The time of concentration for the pre-developed area is 5.08 minutes. Calculations for the time of concentration can be found in Appendix D. The information for the pre developed site conditions are shown in Table 1.

**Table 1: Pre Developed Subarea Characteristics**

	Area (acres)	Land Usage	Impervious Area ( %)	Weighted CN	Time of Concentration (minutes)
Subarea A	0.69	Wooded, Impervious	1.3%	77	12.03
Subarea B	1.19	Wooded, Impervious	0.02%	83	5.08

In subarea A, the pre developed area for the roadway is located in Sub-basin 10 of the Deer Run Watershed per the City of Dublin Stormwater Master Plan. Part of the roadway and proposed lot developments are located outside of this watershed in the unstudied areas and shall comply with the release rates specified in Chapter 2, Section C.1.b. This shall be considered when the separate construction plans and stormwater management plans are submitted for these development lots.

In Subarea B, the pre developed area for the roadway is located in Sub-basins 10 and 20 of the Deer Run Watershed per the City of Dublin Stormwater Master Plan. It should be noted that portions of 3 of the proposed estate lots are located outside of this watershed in the unstudied areas and shall comply with the release rates specified in Chapter 2, Section C.1.b. This shall be considered when the separate construction plans and stormwater management plans are submitted for these development lots. The approximate acreage of the proposed roadway development between the two sub-basins are listed in Table 2, as well as the respective allowable release rates.

**Table 2: Allowable Release Rates**

Deer Run Watershed Release Rate Requirements (from the City of Dublin Stormwater Master Plan)							
	Design Storm (CFS/ac.)						
Sub-Basin	1-year	2-year	5-year	10-year	25-year	50-year	100-year
10	0.10	0.10	0.10	0.30	0.80	1.80	2.80
20	0.10	0.10	0.10	0.40	1.60	3.10	4.40
Unstudied	< 2.0 acres, 0.20						

Allowable Release Rates per Acre								
		Design Storm (CFS/ac.)						
Sub-Basin	Area (ac.)	1-year	2-year	5-year	10-year	25-year	50-year	100-year
Subarea A								
10	0.10	0.01	0.01	0.01	0.03	0.08	0.18	0.28
Unstudied	0.59	0.12	0.12	0.12	0.12	0.12	0.12	0.12
Subarea B								
10	0.66	0.07	0.07	0.07	0.20	0.53	1.19	1.85
20	0.47	0.05	0.05	0.05	0.19	0.75	1.46	2.07

## V. Post Developed Conditions

The proposed roadway construction area is shown in Exhibits 1 and 2. For Subarea A, this includes 0.69-acre development, of which 0.33 acres is comprised of the roadway with a gravel top course and the remaining development includes the proposed grading with the bioretention swales on both sides of the roadway. For subarea B, this includes a total of 1.19-acre development of which 0.47 acres is comprised of the roadway with a gravel top course and the remaining development is the proposed grading including the bioretention swales on both sides of the roadway. Composite runoff numbers were calculated in HydroCAD and are summarized in Table 3.

Exhibits 1 and 2 shows the design of the proposed roadway in Subarea A and B that will provide access to the future estate lots. The remaining estate lots will be designed and will provide separate construction design plans and stormwater management plans. This project will utilize a Bioretention Swale that runs parallel to the roadway and will provide quality treatment for the project.

**Table 3: Post Developed Subarea Characteristics**

	Area (acres)	Land Usage	Impervious Area ( %)	Weighted CN	Time of Concentration (minutes)
Subarea A	0.69	Impervious Area, Wooded Area, Grass Cover	48%	70	*Refer to the Time of Concentration Calcs in Appendix D for the respective drainage areas.
Subarea B	1.19	Impervious Area, Wooded Area, Grass Cover	39%	84	*Refer to the Time of Concentration Calcs in Appendix D for the respective drainage areas.

## VI. Outlet Design

For Subarea A, there is only one outlet for the system. The bioretention swales are graded to the east and drains to the Scioto River.

For Subarea B, there are two outlets for the system. Due to the highpoint location, the proposed ditch could not be graded to the outfall located at the end of the cul-de-sac. Therefore, a proposed storm system was designed. The location of the proposed structures is at Station 1+00 and crosses perpendicular to the roadway. Two catch basins collect the ditch drainage into 12" conduits and outlet them to a roadway ditch that drains to Deer Run. The other outlet for the system is east of the cul-de-sac where the bioretention swale is graded to Deer Run.

## VII. Maintenance and Inspection

The city shall be responsible for the inspection and maintenance of the bioretention swales located alongside the proposed roadway. Inspections and maintenance that are conducted shall be documented by the city. For initial sediment control, please refer to the City of Dublin, Stormwater Management Design Manual, Chapter 8 and the Sediment and Erosion control submitted with the proposed construction plans. The following procedures should be followed for the bioretention swales. Inspection of the storm structures to remove debris or sediment that has accumulated at the catch basins or outlet shall occur once a year. Maintenance (mowing or removal of excess sediment or debris) of the bioretention swales shall occur at a

minimum on a monthly basis or more frequently if needed. More frequent maintenance may need required during the months of April through September, or during heavy rainfalls where runoff might carry debris into the swale and where grass might grow at a much higher rate. Adjustments may be made to this plan upon review of the 1<sup>st</sup> year inspection results.

#### **VIII. Post Construction Water Quality**

The project is a new construction project so water quality treatment is required for a 0.75-inch event. Water Quantity treatment is not required since the project location is located within the River Corridor as per the City of Dublin Stormwater Management Design Manual, Chapter 2, Section 2.A.1.a. The % of impervious area for Subarea A is 1.3% pre development and is 48% post development. For Subarea B it was 0.02% pre development and is 39% post development. By utilizing Vegetated Bioretention Swale alongside the roadway this will allow the proposed soil media to improve the water quality and will also reduce runoff rates, even though quantity treatment is not required. The 12" soil layer under the finished grade of the ditch bottom, provides enhanced infiltration and pollutant removal. Therefore, we are able to treat the required 0.75-inch event for the project. Calculations that show the required volume storage to treat this rainfall event and the storage provided for each bioretention swale are shown in the calculations for the water quality conditions can be found in Appendix B.

Appendix A

Storm Sewer Calculation Sheets

Project Name: Deer Run

## Storm Sewer Calculations

Project Number: Deer RunDate: 11/09/2015

Calculated By: \_\_\_\_\_ ACF

## STRUCTURE DATA

## PIPE CALCULATIONS

DESIGN STORM (year) = 25  
ROUGHNESS COEFFICIENT n = 0.012

## HYDRAULIC GRADE CALCULATIONS

HYDRAULIC GRADE (year) = 10  
PERCENT FULL AT OUTLET = 93%  
TAILWATER ELEVATION = 849.00

[illegible]

## Appendix B

### Post- Construction Water Quality Calculations



## Deer Run Project - Dublin, OH

Functional Classification :

Local Road

*Subarea A LT DITCH*

### Stormwater Management Requirements

**Location of Project:** River Corridor

**Quantity Requirements:** Not applicable

**Quality Requirements:** 0.75 inch event

**Type of Drainage System:** Open Channel

**Hydrologic Soil Group:** B

Ditches shall be designed to carry the 10 year, 24 hr storm.

Open Channels shall be designed with one foot of freeboard above the design water surface elevation for the 10 year, 24-hour storm.

The 100 yr, 24 hour storm shall not encroach into proposed or existing residential dwellings or places of business.

**Method of treating water  
quality for the project:**

*Bioretention Swale*

<b>Pre Construction Impervious Area</b>	0.00 acres
<b>Post Construction Impervious Area</b>	0.10 acres
<b>Total Area</b>	0.27 acres
<b>% of impervious area</b>	37.06%

**Time of Concentration**

**tc = 0.13 hr**

Water Quality Volume (WQv)

$$WQ_V = C * \left(\frac{P}{12}\right) * A$$

C =	0.26339689	
I =	0.3706	
P =	0.75	inches
A =	0.27	acre

*Where,*

$$C = 0.858i^3 - 0.78i^2 + 0.774i + 0.04$$

*i = fraction of post - const. impervious surface*

P = 0.75Precipitation Depth

A = Area tributary to basin, acres

$$WQ_V = 0.0045 \text{ ac-ft}$$

$$194.2619 \text{ CU FT}$$

$$WQ_V \text{ Elevation} = 0.19 \text{ ft water depth in swale}$$

Available Depth in Ditch: 1.55 FT

Available Storage in Ditch: 2,062 CF

## Deer Run Project - Dublin, OH

Functional Classification : Local Road

*Subarea A RT DITCH*

### Stormwater Management Requirements

**Location of Project:** River Corridor

**Quantity Requirements:** Not applicable

**Quality Requirements:** 0.75 inch event

**Type of Drainage System:** Open Channel

**Hydrologic Soil Group:** B

Ditches shall be designed to carry the 10 year, 24 hr storm.

Open Channels shall be designed with one foot of freeboard above the design water surface elevation for the 10 year, 24-hour storm.

The 100 yr, 24 hour storm shall not encroach into proposed or existing residential dwellings or places of business.

**Method of treating water quality for the project:** *Bioretention Swale*

**Pre Construction Impervious Area** 0.009 acres

**Post Construction Impervious Area** 0.229 acres

**Total Area** 0.7253 acres

**% of impervious area** 31.57%

### Time of Concentration

**tc = 0.24 hr**

Water Quality Volume (WQv)

$$WQ_V = C * (P/12) * A$$

C = 0.23363

I = 0.3157

P = 0.75 inches

A = 0.7253 acre

*Where,*

$$C = 0.858i^3 - 0.78i^2 + 0.774i + 0.04$$

*i = fraction of post - const. impervious surface*

P = 0.75 Precipitation Depth

A = Area tributary to basin, acres

$WQ_V =$  0.01059 ac-ft

461.3239 CU FT

$WQ_V$  Elevation = 0.16 ft water depth in swale

Available Depth in Ditch: 1.55 FT

Available Storage in Ditch: 3,010 CF

## Deer Run Project - Dublin, OH

Functional Classification : Local Road

*Subarea B RT DITCH #1*

### Stormwater Management Requirements

**Location of Project:** River Corridor

**Quantity Requirements:** Not applicable

**Quality Requirements:** 0.75 inch event

**Type of Drainage System:** Open Channel

**Hydrologic Soil Group:** D

Ditches shall be designed to carry the 10 year, 24 hr storm.

Open Channels shall be designed with one foot of freeboard above the design water surface elevation for the 10 year, 24-hour storm.

The 100 yr, 24 hour storm shall not encroach into proposed or existing residential dwellings or places of business.

**Method of treating water  
quality for the project:**

*Bioretention Swale*

**Pre Construction  
Impervious Area** 0.022 acres

**Post Construction  
Impervious Area** 0.083 acres

**Total Area** 0.683 acres

**% of impervious area** 12.15%

### Time of Concentration

**tc = 0.12 hr**

Water Quality Volume (WQv)

$$WQ_V = C * \left(\frac{P}{12}\right) * A$$

C = 0.12408

I = 0.1215

P = 0.75 inches

A = 0.6811 acre

*Where,*

$$C = 0.858i^3 - 0.78i^2 + 0.774i + 0.04$$

*i = fraction of post - const. impervious surface*

P = 0.75 Precipitation Depth

A = Area tributary to basin, acres

$WQ_V =$  0.00528 ac-ft

230.0799 CU FT

$WQ_V$  Elevation = 0.16 ft water depth in swale

Available Depth in Ditch: 1.55 FT

Available Storage in Ditch: 2,765 CU FT

## Deer Run Project - Dublin, OH

Functional Classification : Local Road

*Subarea B RT DITCH #2*

### Stormwater Management Requirements

**Location of Project:** River Corridor

**Quantity Requirements:** Not applicable

**Quality Requirements:** 0.75 inch event

**Type of Drainage System:** Open Channel

**Hydrologic Soil Group:** D

Ditches shall be designed to carry the 10 year, 24 hr storm.

Open Channels shall be designed with one foot of freeboard above the design water surface elevation for the 10 year, 24-hour storm.

The 100 yr, 24 hour storm shall not encroach into proposed or existing residential dwellings or places of business.

**Method of treating water quality for the project:** *Bioretention Swale*

**Pre Construction Impervious Area** 0.00 acres

**Post Construction Impervious Area** 0.18 acres

**Total Area** 0.80 acres

**% of impervious area** 22.03%

### Time of Concentration

**tc = 0.24 hr**

Water Quality Volume (WQv)

$$WQ_v = C * \left(\frac{P}{12}\right) * A$$

C = 0.181822

I = 0.2203

P = 0.75 inches

A = 0.8027 acre

*Where,*

$$C = 0.858i^3 - 0.78i^2 + 0.774i + 0.04$$

*i = fraction of post - const. impervious surface*

P = 0.75 Precipitation Depth

A = Area tributary to basin, acres

$$WQ_v = 0.009122 \text{ ac-ft}$$

$$397.34 \text{ CU FT}$$

$$WQ_v \text{ Elevation} = 0.10 \text{ ft water depth in swale}$$

Available Depth in Ditch: 1.55 FT

Available Storage in Ditch: 50,490 CF

## Deer Run Project - Dublin, OH

Functional Classification : Local Road

*Subarea B LT DITCH #1*

### Stormwater Management Requirements

**Location of Project:** River Corridor  
**Quantity Requirements:** Not applicable  
**Quality Requirements:** 0.75 inch event

**Type of Drainage System:** Open Channel  
**Hydrologic Soil Group:** D

Ditches shall be designed to carry the 10 year, 24 hr storm.

Open Channels shall be designed with one foot of freeboard above the design water surface elevation for the 10 year, 24-hour storm.

The 100 yr, 24 hour storm shall not encroach into proposed or existing residential dwellings or places of business.

**Method of treating water quality for the project:** *Bioretention Swale*

<b>Pre Construction Impervious Area</b>	0.006 acres
<b>Post Construction Impervious Area</b>	0.063 acres
<b>Total Area</b>	0.1534 acres
<b>% of impervious area</b>	41.07%

### Time of Concentration

**tc = 0.17 hr**

Water Quality Volume (WQv)

$$WQ_v = C * \left(\frac{P}{12}\right) * A$$

C = 0.285748  
I = 0.4107  
P = 0.75 inches  
A = 0.1534 acre

*Where,*

$$C = 0.858i^3 - 0.78i^2 + 0.774i + 0.04$$

*i = fraction of post - const. impervious surface*

P = 0.75 Precipitation Depth

A = Area tributary to basin, acres

$$WQ_v = 0.00274 \text{ ac-ft} \quad 119.3375 \text{ CU FT}$$

$$WQ_v \text{ Elevation} = 0.10 \text{ ft water depth in swale}$$

Available Depth in Ditch: 1.55 FT

Available Storage in Ditch: 5( 3,162 CF

## Deer Run Project - Dublin, OH

Functional Classification : Local Road

*Subarea B LT DITCH #2*

### Stormwater Management Requirements

**Location of Project:** River Corridor

**Quantity Requirements:** Not applicable

**Quality Requirements:** 0.75 inch event

**Type of Drainage System:** Open Channel

**Hydrologic Soil Group:** D

Ditches shall be designed to carry the 10 year, 24 hr storm.

Open Channels shall be designed with one foot of freeboard above the design water surface elevation for the 10 year, 24-hour storm.

The 100 yr, 24 hour storm shall not encroach into proposed or existing residential dwellings or places of business.

**Method of treating water quality for the project:** *Bioretention Swale*

**Pre Construction Impervious Area** 0 acres

**Post Construction Impervious Area** 0.1485 acres

**Total Area** 0.3471 acres

**% of impervious area** 42.78%

### Time of Concentration

**tc = 0.33 hr**

Water Quality Volume (WQv)

$$WQ_V = C * (P/12) * A$$

C = 0.2956

I = 0.4278

P = 0.75 inches

A = 0.3471 acre

*Where,*

$$C = 0.858i^3 - 0.78i^2 + 0.774i + 0.04$$

*i = fraction of post - const. impervious surface*

P = 0.75 Precipitation Depth

A = Area tributary to basin, acres

$$WQ_V = 0.0064 \text{ ac-ft}$$

$$279.30 \text{ CU FT}$$

$$WQ_V \text{ Elevation} = 0.08 \text{ ft water depth in swale}$$

Available Depth in Ditch: 1.55 FT

Available Storage in Ditch: 5 6,798 CF

## Appendix C

### HydroCAD Reports

## Deer Run A\_LT

Type II 24-hr Rainfall=2.20"

Prepared by HydroCAD SAMPLER 1-800-927-7246 www.hydrocad.net

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### Summary for Subcatchment 3S: Post Const. Runoff Subarea A LT Ditch

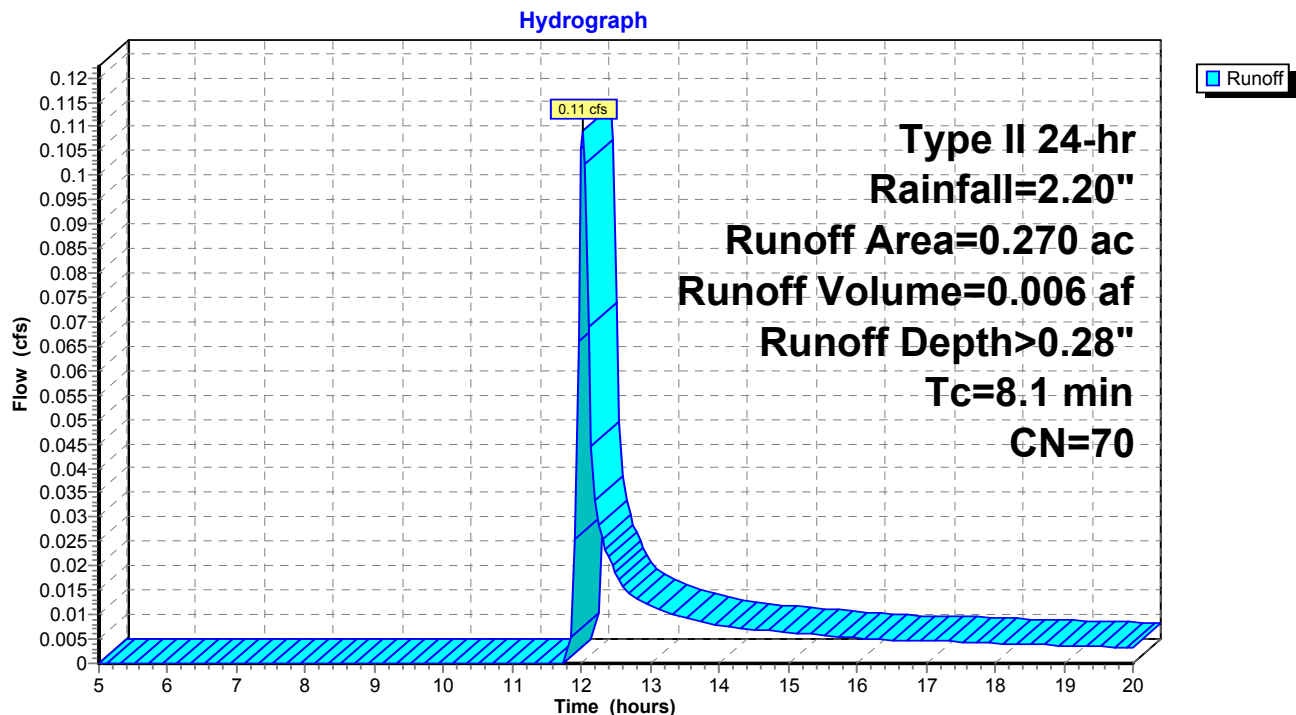
Runoff = 0.11 cfs @ 12.02 hrs, Volume= 0.006 af, Depth> 0.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Type II 24-hr Rainfall=2.20"

Area (ac)	CN	Description
0.170	61	>75% Grass cover, Good, HSG B
0.100	85	Gravel roads, HSG B
0.270	70	Weighted Average
0.270		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1					Direct Entry,

### Subcatchment 3S: Post Const. Runoff Subarea A LT Ditch





## Deer Run A\_LT

Type II 24-hr Rainfall=2.20"

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### Summary for Subcatchment 1S: Pre Const. Runoff Subarea A LT Ditch

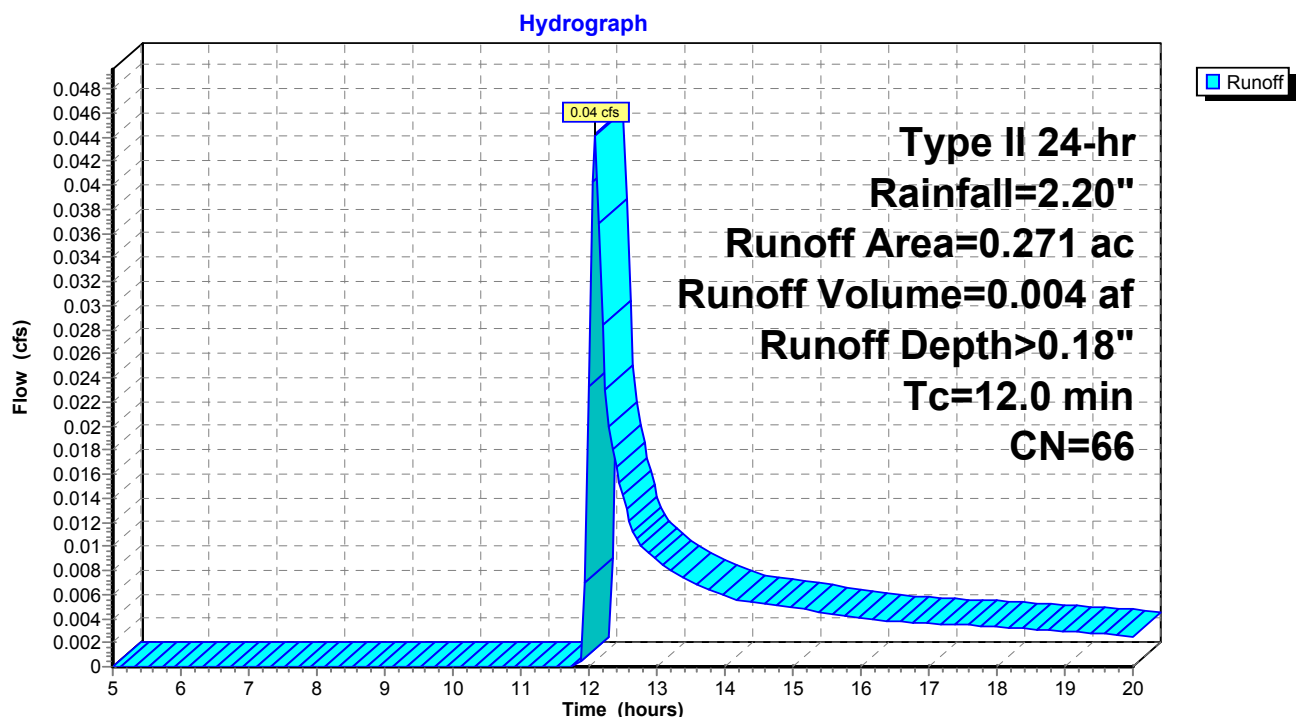
Runoff = 0.04 cfs @ 12.09 hrs, Volume= 0.004 af, Depth> 0.18"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Type II 24-hr Rainfall=2.20"

Area (ac)	CN	Description
0.271	66	Woods, Poor, HSG B
0.271		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.0					Direct Entry,

### Subcatchment 1S: Pre Const. Runoff Subarea A LT Ditch



**Deer Run A\_LT***Type II 24-hr Rainfall=2.20"*Prepared by HydroCAD SAMPLER 1-800-927-7246 [www.hydrocad.net](http://www.hydrocad.net)

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**Hydrograph for Subcatchment 1S: Pre Const. Runoff Subarea A LT Ditch**

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)	Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
5.00	0.14	0.00	0.00	16.50	1.96	0.14	0.00
5.25	0.15	0.00	0.00	16.75	1.97	0.15	0.00
5.50	0.16	0.00	0.00	17.00	1.98	0.15	0.00
5.75	0.17	0.00	0.00	17.25	1.99	0.15	0.00
6.00	0.18	0.00	0.00	17.50	2.01	0.16	0.00
6.25	0.19	0.00	0.00	17.75	2.02	0.16	0.00
6.50	0.20	0.00	0.00	18.00	2.03	0.16	0.00
6.75	0.21	0.00	0.00	18.25	2.04	0.16	0.00
7.00	0.22	0.00	0.00	18.50	2.05	0.17	0.00
7.25	0.23	0.00	0.00	18.75	2.05	0.17	0.00
7.50	0.24	0.00	0.00	19.00	2.06	0.17	0.00
7.75	0.25	0.00	0.00	19.25	2.07	0.18	0.00
8.00	0.26	0.00	0.00	19.50	2.08	0.18	0.00
8.25	0.28	0.00	0.00	19.75	2.09	0.18	0.00
8.50	0.29	0.00	0.00	20.00	<b>2.09</b>	<b>0.18</b>	0.00
8.75	0.31	0.00	0.00				
9.00	0.32	0.00	0.00				
9.25	0.34	0.00	0.00				
9.50	0.36	0.00	0.00				
9.75	0.38	0.00	0.00				
10.00	0.40	0.00	0.00				
10.25	0.42	0.00	0.00				
10.50	0.45	0.00	0.00				
10.75	0.48	0.00	0.00				
11.00	0.52	0.00	0.00				
11.25	0.56	0.00	0.00				
11.50	0.62	0.00	0.00				
11.75	0.85	0.00	0.00				
12.00	1.46	0.03	<b>0.02</b>				
12.25	1.55	0.05	<b>0.02</b>				
12.50	1.62	0.06	0.01				
12.75	1.66	0.07	0.01				
13.00	1.70	0.08	0.01				
13.25	1.73	0.08	0.01				
13.50	1.76	0.09	0.01				
13.75	1.78	0.10	0.01				
14.00	1.80	0.10	0.01				
14.25	1.82	0.11	0.01				
14.50	1.84	0.11	0.01				
14.75	1.86	0.12	0.01				
15.00	1.88	0.12	0.00				
15.25	1.89	0.12	0.00				
15.50	1.91	0.13	0.00				
15.75	1.92	0.13	0.00				
16.00	1.94	0.14	0.00				
16.25	1.95	0.14	0.00				

**Deer Run A\_LT***Type II 24-hr Rainfall=2.20"*Prepared by HydroCAD SAMPLER 1-800-927-7246 [www.hydrocad.net](http://www.hydrocad.net)

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**Hydrograph for Subcatchment 3S: Post Const. Runoff Subarea A LT Ditch**

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)	Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
5.00	0.14	0.00	0.00	16.50	1.96	0.23	0.00
5.25	0.15	0.00	0.00	16.75	1.97	0.23	0.00
5.50	0.16	0.00	0.00	17.00	1.98	0.23	0.00
5.75	0.17	0.00	0.00	17.25	1.99	0.24	0.00
6.00	0.18	0.00	0.00	17.50	2.01	0.24	0.00
6.25	0.19	0.00	0.00	17.75	2.02	0.25	0.00
6.50	0.20	0.00	0.00	18.00	2.03	0.25	0.00
6.75	0.21	0.00	0.00	18.25	2.04	0.25	0.00
7.00	0.22	0.00	0.00	18.50	2.05	0.26	0.00
7.25	0.23	0.00	0.00	18.75	2.05	0.26	0.00
7.50	0.24	0.00	0.00	19.00	2.06	0.26	0.00
7.75	0.25	0.00	0.00	19.25	2.07	0.27	0.00
8.00	0.26	0.00	0.00	19.50	2.08	0.27	0.00
8.25	0.28	0.00	0.00	19.75	2.09	0.27	0.00
8.50	0.29	0.00	0.00	20.00	<b>2.09</b>	<b>0.28</b>	0.00
8.75	0.31	0.00	0.00				
9.00	0.32	0.00	0.00				
9.25	0.34	0.00	0.00				
9.50	0.36	0.00	0.00				
9.75	0.38	0.00	0.00				
10.00	0.40	0.00	0.00				
10.25	0.42	0.00	0.00				
10.50	0.45	0.00	0.00				
10.75	0.48	0.00	0.00				
11.00	0.52	0.00	0.00				
11.25	0.56	0.00	0.00				
11.50	0.62	0.00	0.00				
11.75	0.85	0.00	0.00				
12.00	1.46	0.07	<b>0.11</b>				
12.25	1.55	0.10	0.03				
12.50	1.62	0.11	0.02				
12.75	1.66	0.13	0.01				
13.00	1.70	0.14	0.01				
13.25	1.73	0.15	0.01				
13.50	1.76	0.16	0.01				
13.75	1.78	0.16	0.01				
14.00	1.80	0.17	0.01				
14.25	1.82	0.18	0.01				
14.50	1.84	0.18	0.01				
14.75	1.86	0.19	0.01				
15.00	1.88	0.20	0.01				
15.25	1.89	0.20	0.01				
15.50	1.91	0.21	0.01				
15.75	1.92	0.21	0.01				
16.00	1.94	0.22	0.01				
16.25	1.95	0.22	0.00				

## Deer Run A\_LT

Type II 24-hr Rainfall=2.20"

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### Summary for Reach 4R: Biofilter

Inflow Area = 0.156 ac, 0.00% Impervious, Inflow Depth > 0.30"  
Inflow = 0.07 cfs @ 12.01 hrs, Volume= 0.004 af  
Outflow = 0.07 cfs @ 12.10 hrs, Volume= 0.004 af, Atten= 10%, Lag= 5.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Max. Velocity= 1.22 fps, Min. Travel Time= 2.7 min  
Avg. Velocity = 0.84 fps, Avg. Travel Time= 4.0 min

Peak Storage= 11 cf @ 12.05 hrs  
Average Depth at Peak Storage= 0.03'  
Bank-Full Depth= 1.55' Flow Area= 10.3 sf, Capacity= 127.75 cfs

2.00' x 1.55' deep channel, n= 0.030  
Side Slope Z-value= 3.0 ' ' Top Width= 11.30'  
Length= 200.0' Slope= 0.0750 ' '  
Inlet Invert= 830.00', Outlet Invert= 815.00'



## Deer Run A\_LT

Type II 24-hr Rainfall=2.20"

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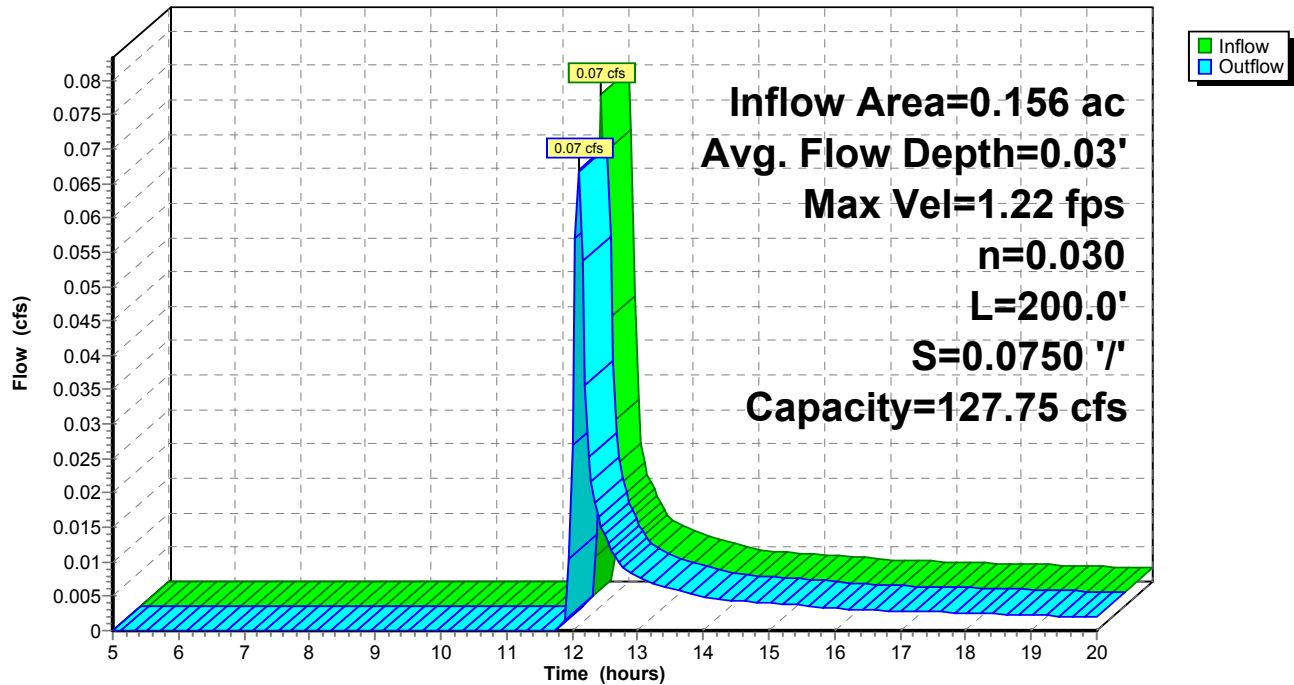
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### Reach 4R: Biofilter

#### Hydrograph



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**Hydrograph for Reach 4R: Biofilter**

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Outflow (cfs)
5.00	0.00	0	830.00	0.00
5.50	0.00	0	830.00	0.00
6.00	0.00	0	830.00	0.00
6.50	0.00	0	830.00	0.00
7.00	0.00	0	830.00	0.00
7.50	0.00	0	830.00	0.00
8.00	0.00	0	830.00	0.00
8.50	0.00	0	830.00	0.00
9.00	0.00	0	830.00	0.00
9.50	0.00	0	830.00	0.00
10.00	0.00	0	830.00	0.00
10.50	0.00	0	830.00	0.00
11.00	0.00	0	830.00	0.00
11.50	0.00	0	830.00	0.00
12.00	<b>0.07</b>	<b>10</b>	<b>830.02</b>	<b>0.03</b>
12.50	0.01	<b>3</b>	<b>830.01</b>	<b>0.01</b>
13.00	0.01	2	830.00	0.01
13.50	0.01	1	830.00	0.01
14.00	0.00	1	830.00	0.00
14.50	0.00	1	830.00	0.00
15.00	0.00	1	830.00	0.00
15.50	0.00	1	830.00	0.00
16.00	0.00	1	830.00	0.00
16.50	0.00	1	830.00	0.00
17.00	0.00	1	830.00	0.00
17.50	0.00	1	830.00	0.00
18.00	0.00	1	830.00	0.00
18.50	0.00	1	830.00	0.00
19.00	0.00	1	830.00	0.00
19.50	0.00	1	830.00	0.00
20.00	0.00	0	830.00	0.00

## Deer Run A\_LT

Type II 24-hr Rainfall=2.20"

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### Summary for Subcatchment 3S: Post Const. Runoff Subarea A LT Ditch

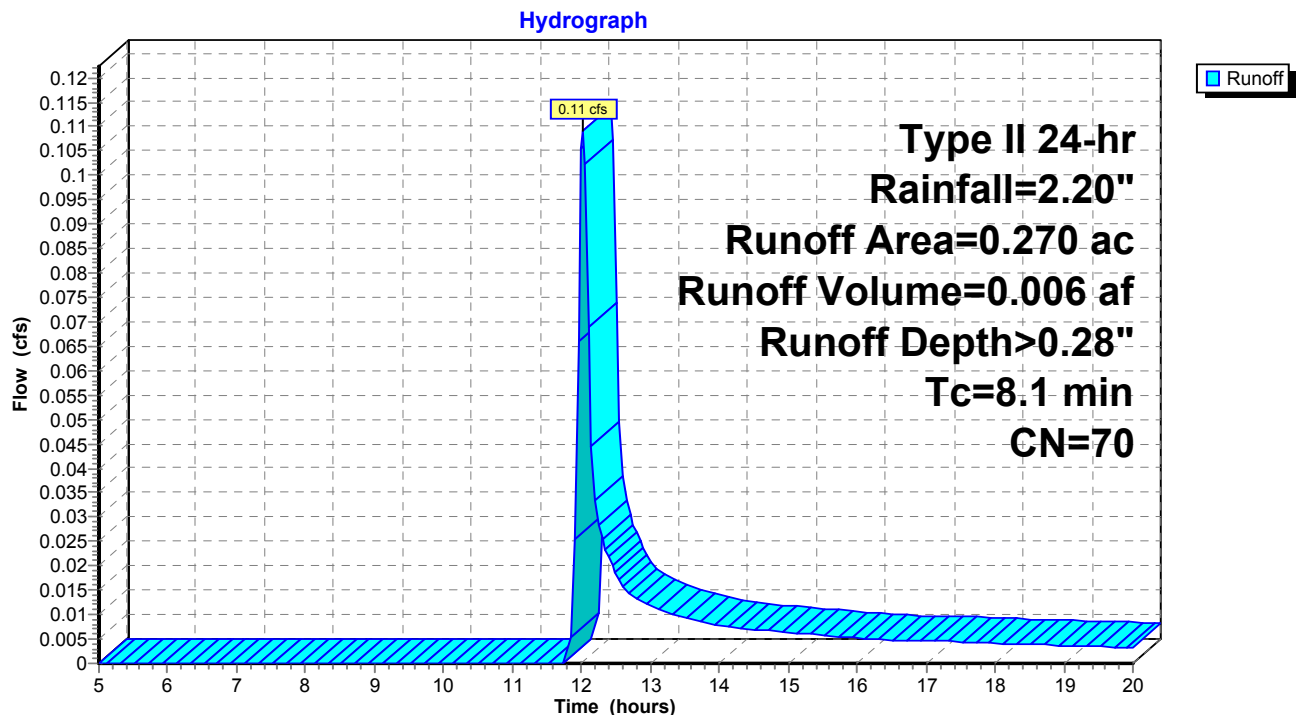
Runoff = 0.11 cfs @ 12.02 hrs, Volume= 0.006 af, Depth> 0.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Type II 24-hr Rainfall=2.20"

Area (ac)	CN	Description
0.170	61	>75% Grass cover, Good, HSG B
0.100	85	Gravel roads, HSG B
0.270	70	Weighted Average
0.270		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1					Direct Entry,

### Subcatchment 3S: Post Const. Runoff Subarea A LT Ditch



**Deer Run A\_LT***Type II 24-hr Rainfall=2.20"*Prepared by HydroCAD SAMPLER 1-800-927-7246 [www.hydrocad.net](http://www.hydrocad.net)

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**Hydrograph for Subcatchment 3S: Post Const. Runoff Subarea A LT Ditch**

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)	Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
5.00	0.14	0.00	0.00	16.50	1.96	0.23	0.00
5.25	0.15	0.00	0.00	16.75	1.97	0.23	0.00
5.50	0.16	0.00	0.00	17.00	1.98	0.23	0.00
5.75	0.17	0.00	0.00	17.25	1.99	0.24	0.00
6.00	0.18	0.00	0.00	17.50	2.01	0.24	0.00
6.25	0.19	0.00	0.00	17.75	2.02	0.25	0.00
6.50	0.20	0.00	0.00	18.00	2.03	0.25	0.00
6.75	0.21	0.00	0.00	18.25	2.04	0.25	0.00
7.00	0.22	0.00	0.00	18.50	2.05	0.26	0.00
7.25	0.23	0.00	0.00	18.75	2.05	0.26	0.00
7.50	0.24	0.00	0.00	19.00	2.06	0.26	0.00
7.75	0.25	0.00	0.00	19.25	2.07	0.27	0.00
8.00	0.26	0.00	0.00	19.50	2.08	0.27	0.00
8.25	0.28	0.00	0.00	19.75	2.09	0.27	0.00
8.50	0.29	0.00	0.00	20.00	<b>2.09</b>	<b>0.28</b>	0.00
8.75	0.31	0.00	0.00				
9.00	0.32	0.00	0.00				
9.25	0.34	0.00	0.00				
9.50	0.36	0.00	0.00				
9.75	0.38	0.00	0.00				
10.00	0.40	0.00	0.00				
10.25	0.42	0.00	0.00				
10.50	0.45	0.00	0.00				
10.75	0.48	0.00	0.00				
11.00	0.52	0.00	0.00				
11.25	0.56	0.00	0.00				
11.50	0.62	0.00	0.00				
11.75	0.85	0.00	0.00				
12.00	1.46	0.07	<b>0.11</b>				
12.25	1.55	0.10	0.03				
12.50	1.62	0.11	0.02				
12.75	1.66	0.13	0.01				
13.00	1.70	0.14	0.01				
13.25	1.73	0.15	0.01				
13.50	1.76	0.16	0.01				
13.75	1.78	0.16	0.01				
14.00	1.80	0.17	0.01				
14.25	1.82	0.18	0.01				
14.50	1.84	0.18	0.01				
14.75	1.86	0.19	0.01				
15.00	1.88	0.20	0.01				
15.25	1.89	0.20	0.01				
15.50	1.91	0.21	0.01				
15.75	1.92	0.21	0.01				
16.00	1.94	0.22	0.01				
16.25	1.95	0.22	0.00				



## Deer Run A\_LT

Type II 24-hr Rainfall=2.20"

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### Summary for Reach 4R: Biofilter

Inflow Area = 0.270 ac, 0.00% Impervious, Inflow Depth > 0.28"  
Inflow = 0.11 cfs @ 12.02 hrs, Volume= 0.006 af  
Outflow = 0.10 cfs @ 12.11 hrs, Volume= 0.006 af, Atten= 9%, Lag= 5.2 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Max. Velocity= 1.46 fps, Min. Travel Time= 2.9 min  
Avg. Velocity = 0.91 fps, Avg. Travel Time= 4.6 min

Peak Storage= 17 cf @ 12.06 hrs  
Average Depth at Peak Storage= 0.03'  
Bank-Full Depth= 1.55' Flow Area= 10.3 sf, Capacity= 138.06 cfs

2.00' x 1.55' deep channel, n= 0.030  
Side Slope Z-value= 3.0 ' ' Top Width= 11.30'  
Length= 250.0' Slope= 0.0876 ' '  
Inlet Invert= 831.60', Outlet Invert= 809.70'



## Deer Run A\_LT

Type II 24-hr Rainfall=2.20"

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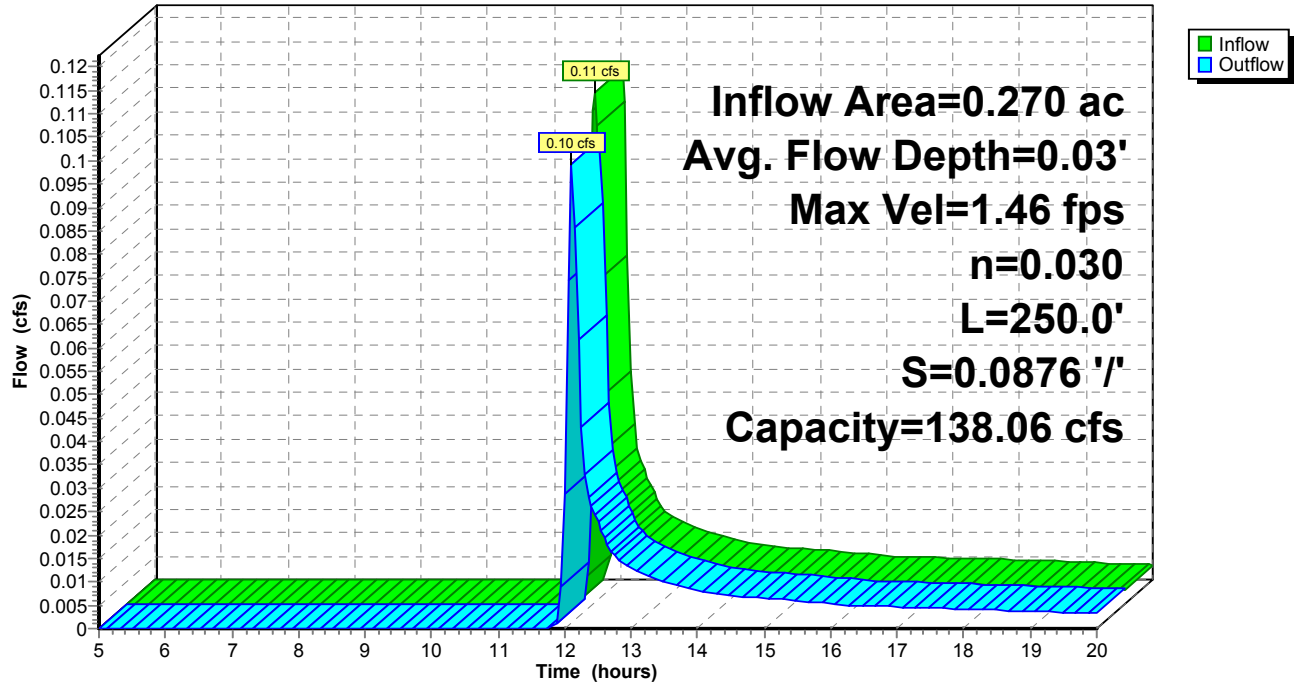
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### Reach 4R: Biofilter

#### Hydrograph



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**Hydrograph for Reach 4R: Biofilter**

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Outflow (cfs)
5.00	0.00	0	831.60	0.00
5.50	0.00	0	831.60	0.00
6.00	0.00	0	831.60	0.00
6.50	0.00	0	831.60	0.00
7.00	0.00	0	831.60	0.00
7.50	0.00	0	831.60	0.00
8.00	0.00	0	831.60	0.00
8.50	0.00	0	831.60	0.00
9.00	0.00	0	831.60	0.00
9.50	0.00	0	831.60	0.00
10.00	0.00	0	831.60	0.00
10.50	0.00	0	831.60	0.00
11.00	0.00	0	831.60	0.00
11.50	0.00	0	831.60	0.00
12.00	<b>0.11</b>	<b>14</b>	<b>831.63</b>	<b>0.03</b>
12.50	0.02	<b>6</b>	<b>831.61</b>	<b>0.02</b>
13.00	0.01	4	831.61	0.01
13.50	0.01	3	831.61	0.01
14.00	0.01	2	831.60	0.01
14.50	0.01	2	831.60	0.01
15.00	0.01	2	831.60	0.01
15.50	0.01	2	831.60	0.01
16.00	0.01	1	831.60	0.01
16.50	0.00	1	831.60	0.00
17.00	0.00	1	831.60	0.00
17.50	0.00	1	831.60	0.00
18.00	0.00	1	831.60	0.00
18.50	0.00	1	831.60	0.00
19.00	0.00	1	831.60	0.00
19.50	0.00	1	831.60	0.00
20.00	0.00	1	831.60	0.00

## Deer Run A\_RT

Type II 24-hr Rainfall=2.20"

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### Summary for Subcatchment 1S: Pre Const. Runoff Subarea A RT Ditch

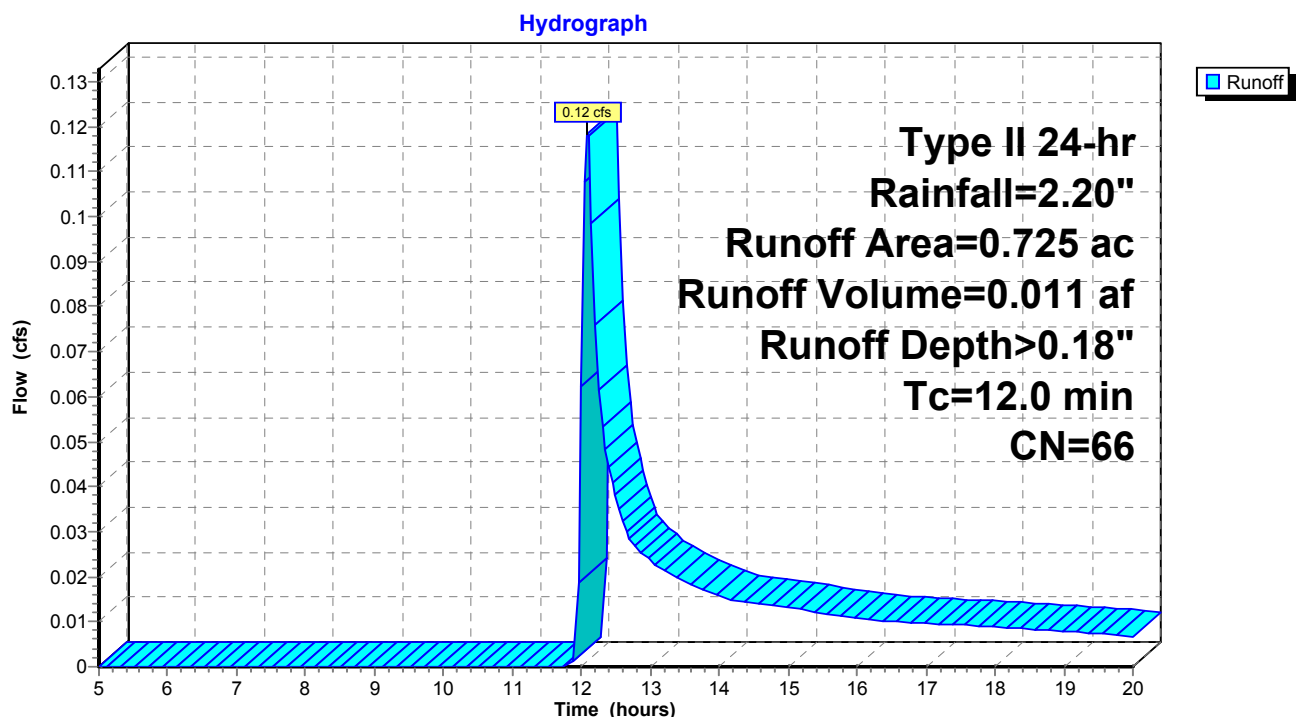
Runoff = 0.12 cfs @ 12.09 hrs, Volume= 0.011 af, Depth> 0.18"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Type II 24-hr Rainfall=2.20"

Area (ac)	CN	Description
0.725	66	Woods, Poor, HSG B
0.725		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.0					Direct Entry,

### Subcatchment 1S: Pre Const. Runoff Subarea A RT Ditch



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**Hydrograph for Subcatchment 1S: Pre Const. Runoff Subarea A RT Ditch**

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)	Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
5.00	0.14	0.00	0.00	16.50	1.96	0.14	0.01
5.25	0.15	0.00	0.00	16.75	1.97	0.15	0.01
5.50	0.16	0.00	0.00	17.00	1.98	0.15	0.01
5.75	0.17	0.00	0.00	17.25	1.99	0.15	0.01
6.00	0.18	0.00	0.00	17.50	2.01	0.16	0.01
6.25	0.19	0.00	0.00	17.75	2.02	0.16	0.01
6.50	0.20	0.00	0.00	18.00	2.03	0.16	0.01
6.75	0.21	0.00	0.00	18.25	2.04	0.16	0.01
7.00	0.22	0.00	0.00	18.50	2.05	0.17	0.01
7.25	0.23	0.00	0.00	18.75	2.05	0.17	0.01
7.50	0.24	0.00	0.00	19.00	2.06	0.17	0.01
7.75	0.25	0.00	0.00	19.25	2.07	0.18	0.01
8.00	0.26	0.00	0.00	19.50	2.08	0.18	0.01
8.25	0.28	0.00	0.00	19.75	2.09	0.18	0.01
8.50	0.29	0.00	0.00	20.00	<b>2.09</b>	<b>0.18</b>	0.01
8.75	0.31	0.00	0.00				
9.00	0.32	0.00	0.00				
9.25	0.34	0.00	0.00				
9.50	0.36	0.00	0.00				
9.75	0.38	0.00	0.00				
10.00	0.40	0.00	0.00				
10.25	0.42	0.00	0.00				
10.50	0.45	0.00	0.00				
10.75	0.48	0.00	0.00				
11.00	0.52	0.00	0.00				
11.25	0.56	0.00	0.00				
11.50	0.62	0.00	0.00				
11.75	0.85	0.00	0.00				
12.00	1.46	0.03	<b>0.06</b>				
12.25	1.55	0.05	<b>0.06</b>				
12.50	1.62	0.06	0.04				
12.75	1.66	0.07	0.03				
13.00	1.70	0.08	0.02				
13.25	1.73	0.08	0.02				
13.50	1.76	0.09	0.02				
13.75	1.78	0.10	0.02				
14.00	1.80	0.10	0.02				
14.25	1.82	0.11	0.01				
14.50	1.84	0.11	0.01				
14.75	1.86	0.12	0.01				
15.00	1.88	0.12	0.01				
15.25	1.89	0.12	0.01				
15.50	1.91	0.13	0.01				
15.75	1.92	0.13	0.01				
16.00	1.94	0.14	0.01				
16.25	1.95	0.14	0.01				

## Deer Run A\_RT

Type II 24-hr Rainfall=2.20"

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### Summary for Subcatchment 3S: Post Const. Runoff Subarea A RT Ditch

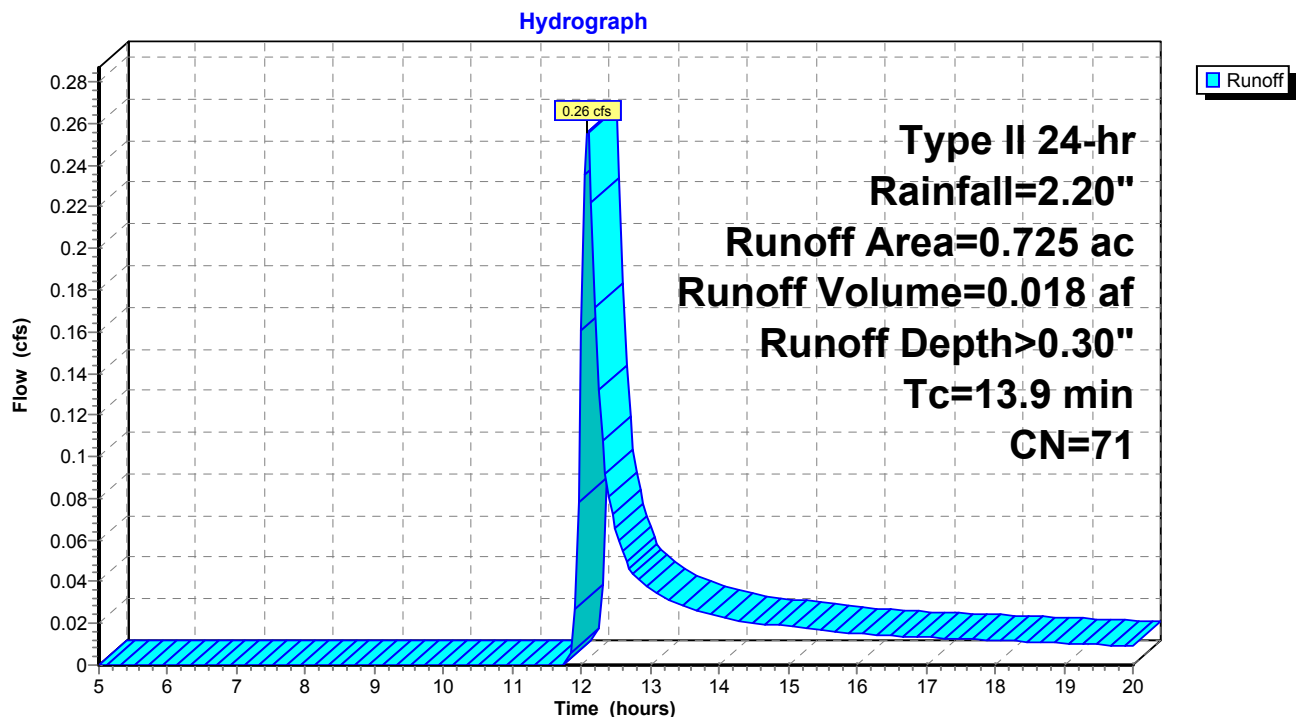
Runoff = 0.26 cfs @ 12.09 hrs, Volume= 0.018 af, Depth> 0.30"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Type II 24-hr Rainfall=2.20"

Area (ac)	CN	Description
0.305	66	Woods, Poor, HSG B
0.229	85	Gravel roads, HSG B
0.191	61	>75% Grass cover, Good, HSG B
0.725	71	Weighted Average
0.725		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.9					Direct Entry, Tc

### Subcatchment 3S: Post Const. Runoff Subarea A RT Ditch



**Deer Run A\_RT***Type II 24-hr Rainfall=2.20"*Prepared by HydroCAD SAMPLER 1-800-927-7246 [www.hydrocad.net](http://www.hydrocad.net)

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**Hydrograph for Subcatchment 3S: Post Const. Runoff Subarea A RT Ditch**

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)	Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
5.00	0.14	0.00	0.00	16.50	1.96	0.25	0.01
5.25	0.15	0.00	0.00	16.75	1.97	0.25	0.01
5.50	0.16	0.00	0.00	17.00	1.98	0.26	0.01
5.75	0.17	0.00	0.00	17.25	1.99	0.26	0.01
6.00	0.18	0.00	0.00	17.50	2.01	0.27	0.01
6.25	0.19	0.00	0.00	17.75	2.02	0.27	0.01
6.50	0.20	0.00	0.00	18.00	2.03	0.28	0.01
6.75	0.21	0.00	0.00	18.25	2.04	0.28	0.01
7.00	0.22	0.00	0.00	18.50	2.05	0.28	0.01
7.25	0.23	0.00	0.00	18.75	2.05	0.29	0.01
7.50	0.24	0.00	0.00	19.00	2.06	0.29	0.01
7.75	0.25	0.00	0.00	19.25	2.07	0.29	0.01
8.00	0.26	0.00	0.00	19.50	2.08	0.30	0.01
8.25	0.28	0.00	0.00	19.75	2.09	0.30	0.01
8.50	0.29	0.00	0.00	20.00	<b>2.09</b>	<b>0.30</b>	0.01
8.75	0.31	0.00	0.00				
9.00	0.32	0.00	0.00				
9.25	0.34	0.00	0.00				
9.50	0.36	0.00	0.00				
9.75	0.38	0.00	0.00				
10.00	0.40	0.00	0.00				
10.25	0.42	0.00	0.00				
10.50	0.45	0.00	0.00				
10.75	0.48	0.00	0.00				
11.00	0.52	0.00	0.00				
11.25	0.56	0.00	0.00				
11.50	0.62	0.00	0.00				
11.75	0.85	0.00	0.00				
12.00	1.46	0.09	<b>0.16</b>				
12.25	1.55	0.11	<b>0.13</b>				
12.50	1.62	0.13	0.07				
12.75	1.66	0.14	0.04				
13.00	1.70	0.16	0.04				
13.25	1.73	0.17	0.03				
13.50	1.76	0.18	0.03				
13.75	1.78	0.18	0.03				
14.00	1.80	0.19	0.02				
14.25	1.82	0.20	0.02				
14.50	1.84	0.21	0.02				
14.75	1.86	0.21	0.02				
15.00	1.88	0.22	0.02				
15.25	1.89	0.22	0.02				
15.50	1.91	0.23	0.02				
15.75	1.92	0.24	0.02				
16.00	1.94	0.24	0.02				
16.25	1.95	0.25	0.01				

## Deer Run A\_RT

Type II 24-hr Rainfall=2.20"

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### Summary for Reach 4R: Biofilter

Inflow Area = 0.725 ac, 0.00% Impervious, Inflow Depth > 0.30"  
Inflow = 0.26 cfs @ 12.09 hrs, Volume= 0.018 af  
Outflow = 0.24 cfs @ 12.17 hrs, Volume= 0.018 af, Atten= 4%, Lag= 4.3 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Max. Velocity= 2.03 fps, Min. Travel Time= 2.5 min  
Avg. Velocity = 0.96 fps, Avg. Travel Time= 5.2 min

Peak Storage= 36 cf @ 12.12 hrs  
Average Depth at Peak Storage= 0.06'  
Bank-Full Depth= 1.55' Flow Area= 10.3 sf, Capacity= 138.06 cfs

2.00' x 1.55' deep channel, n= 0.030  
Side Slope Z-value= 3.0 ' ' Top Width= 11.30'  
Length= 300.0' Slope= 0.0876 ' '  
Inlet Invert= 831.60', Outlet Invert= 805.32'





## Deer Run A\_RT

Type II 24-hr Rainfall=2.20"

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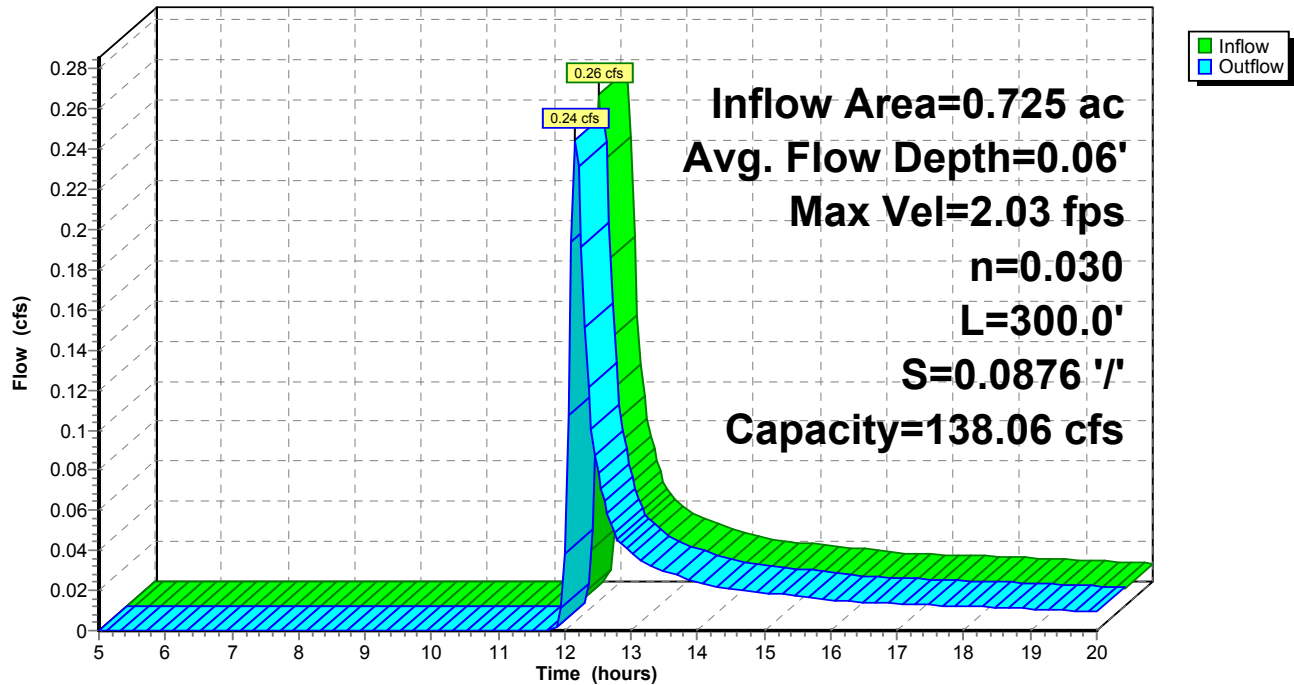
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### Reach 4R: Biofilter

#### Hydrograph



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**Hydrograph for Reach 4R: Biofilter**

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Outflow (cfs)
5.00	0.00	0	831.60	0.00
5.50	0.00	0	831.60	0.00
6.00	0.00	0	831.60	0.00
6.50	0.00	0	831.60	0.00
7.00	0.00	0	831.60	0.00
7.50	0.00	0	831.60	0.00
8.00	0.00	0	831.60	0.00
8.50	0.00	0	831.60	0.00
9.00	0.00	0	831.60	0.00
9.50	0.00	0	831.60	0.00
10.00	0.00	0	831.60	0.00
10.50	0.00	0	831.60	0.00
11.00	0.00	0	831.60	0.00
11.50	0.00	0	831.60	0.00
12.00	<b>0.16</b>	<b>20</b>	<b>831.63</b>	<b>0.04</b>
12.50	<b>0.07</b>	<b>17</b>	<b>831.63</b>	<b>0.08</b>
13.00	0.04	11	831.62	0.04
13.50	0.03	10	831.62	0.03
14.00	0.02	8	831.61	0.02
14.50	0.02	7	831.61	0.02
15.00	0.02	6	831.61	0.02
15.50	0.02	6	831.61	0.02
16.00	0.02	5	831.61	0.02
16.50	0.01	5	831.61	0.01
17.00	0.01	4	831.61	0.01
17.50	0.01	4	831.61	0.01
18.00	0.01	4	831.61	0.01
18.50	0.01	4	831.61	0.01
19.00	0.01	4	831.61	0.01
19.50	0.01	3	831.61	0.01
20.00	0.01	3	831.61	0.01

## Deer Run B\_LT1

Type II 24-hr Rainfall=2.20"

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### Summary for Subcatchment 1S: Pre Const. Runoff Subarea B LT Ditch #1

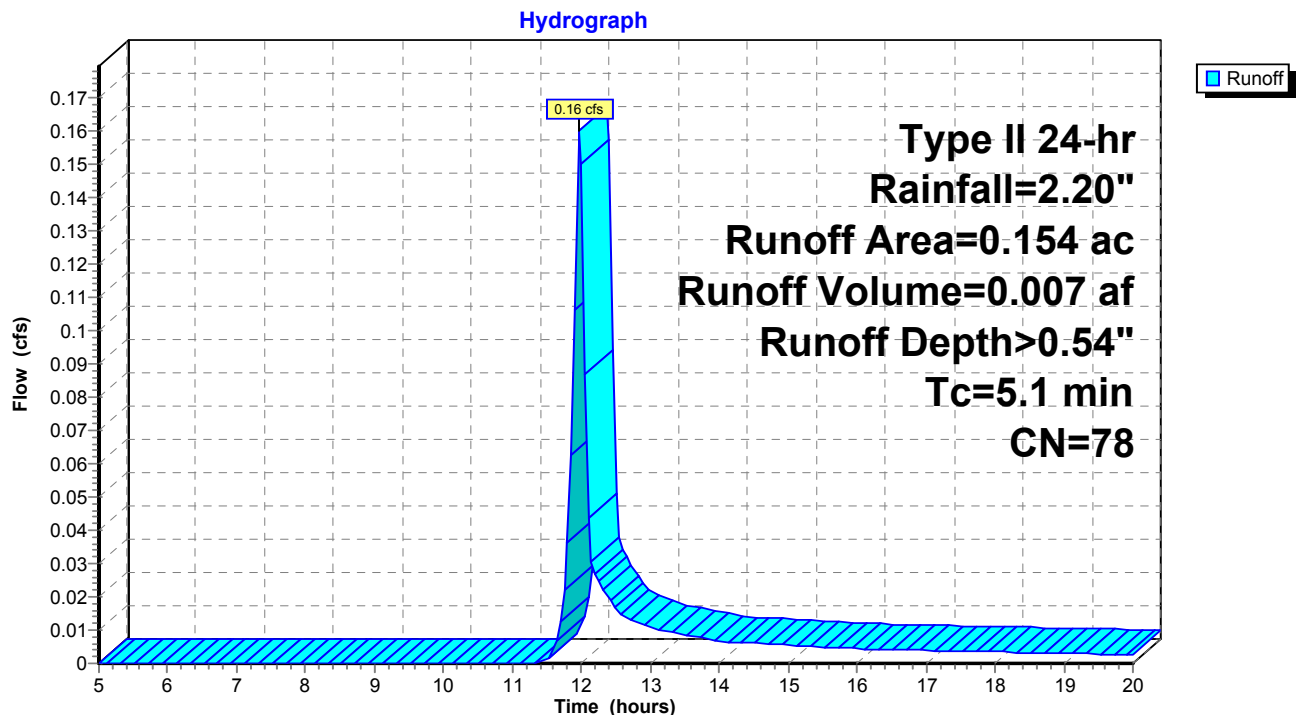
Runoff = 0.16 cfs @ 11.97 hrs, Volume= 0.007 af, Depth> 0.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Type II 24-hr Rainfall=2.20"

Area (ac)	CN	Description
0.148	77	Woods, Good, HSG D
0.006	91	Gravel roads, HSG D
0.154	78	Weighted Average
0.154		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1					Direct Entry,

### Subcatchment 1S: Pre Const. Runoff Subarea B LT Ditch #1



**Deer Run B\_LT1**

Type II 24-hr Rainfall=2.20"

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**Hydrograph for Subcatchment 1S: Pre Const. Runoff Subarea B LT Ditch #1**

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)	Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
5.00	0.14	0.00	0.00	16.50	1.96	0.46	0.00
5.25	0.15	0.00	0.00	16.75	1.97	0.47	0.00
5.50	0.16	0.00	0.00	17.00	1.98	0.48	0.00
5.75	0.17	0.00	0.00	17.25	1.99	0.48	0.00
6.00	0.18	0.00	0.00	17.50	2.01	0.49	0.00
6.25	0.19	0.00	0.00	17.75	2.02	0.49	0.00
6.50	0.20	0.00	0.00	18.00	2.03	0.50	0.00
6.75	0.21	0.00	0.00	18.25	2.04	0.50	0.00
7.00	0.22	0.00	0.00	18.50	2.05	0.51	0.00
7.25	0.23	0.00	0.00	18.75	2.05	0.52	0.00
7.50	0.24	0.00	0.00	19.00	2.06	0.52	0.00
7.75	0.25	0.00	0.00	19.25	2.07	0.52	0.00
8.00	0.26	0.00	0.00	19.50	2.08	0.53	0.00
8.25	0.28	0.00	0.00	19.75	2.09	0.53	0.00
8.50	0.29	0.00	0.00	20.00	<b>2.09</b>	<b>0.54</b>	0.00
8.75	0.31	0.00	0.00				
9.00	0.32	0.00	0.00				
9.25	0.34	0.00	0.00				
9.50	0.36	0.00	0.00				
9.75	0.38	0.00	0.00				
10.00	0.40	0.00	0.00				
10.25	0.42	0.00	0.00				
10.50	0.45	0.00	0.00				
10.75	0.48	0.00	0.00				
11.00	0.52	0.00	0.00				
11.25	0.56	0.00	0.00				
11.50	0.62	0.00	0.00				
11.75	0.85	0.03	<b>0.02</b>				
12.00	1.46	0.22	<b>0.15</b>				
12.25	1.55	0.26	0.02				
12.50	1.62	0.29	0.02				
12.75	1.66	0.31	0.01				
13.00	1.70	0.33	0.01				
13.25	1.73	0.34	0.01				
13.50	1.76	0.35	0.01				
13.75	1.78	0.37	0.01				
14.00	1.80	0.38	0.01				
14.25	1.82	0.39	0.01				
14.50	1.84	0.40	0.01				
14.75	1.86	0.41	0.01				
15.00	1.88	0.42	0.01				
15.25	1.89	0.43	0.01				
15.50	1.91	0.43	0.00				
15.75	1.92	0.44	0.00				
16.00	1.94	0.45	0.00				
16.25	1.95	0.46	0.00				

## Deer Run B\_LT1

Type II 24-hr Rainfall=2.20"

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### Summary for Subcatchment 3S: Post Const. RunoffSubarea B LT Ditch #1

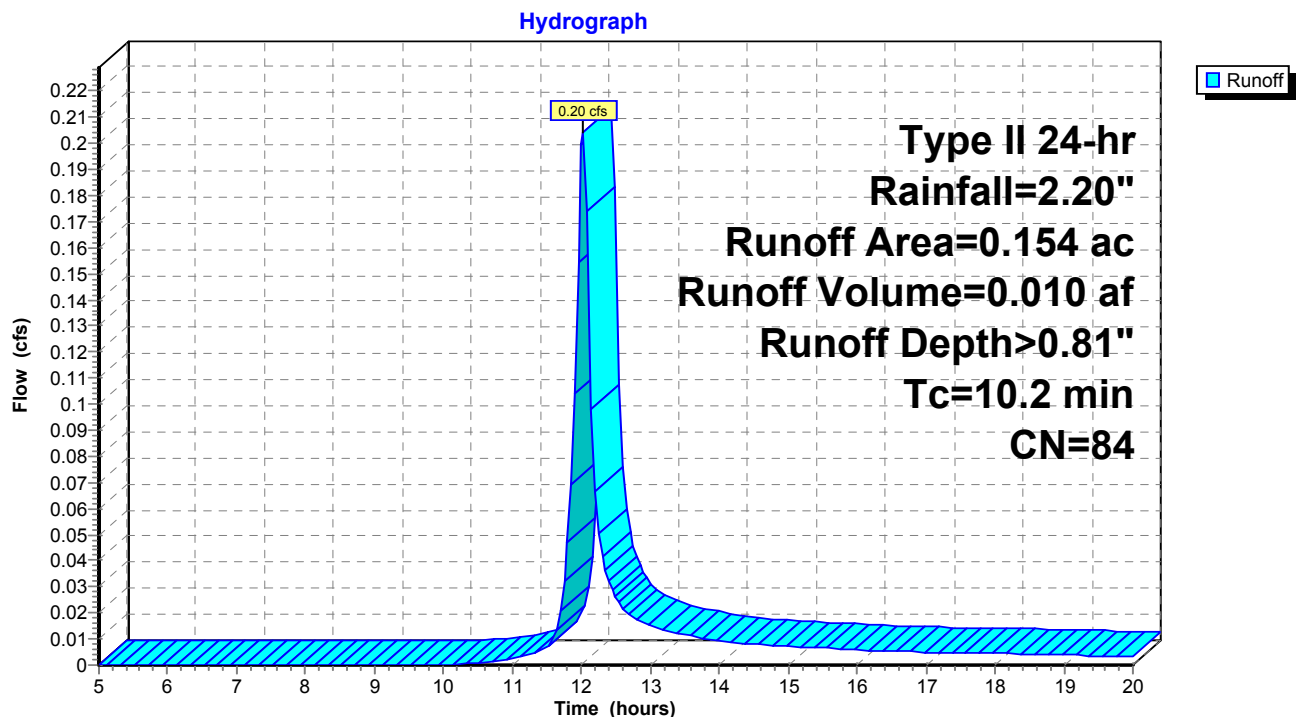
Runoff = 0.20 cfs @ 12.02 hrs, Volume= 0.010 af, Depth> 0.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Type II 24-hr Rainfall=2.20"

Area (ac)	CN	Description
0.009	77	Woods, Good, HSG D
0.063	91	Gravel roads, HSG D
0.082	80	>75% Grass cover, Good, HSG D
0.154	84	Weighted Average
0.154		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.2					Direct Entry, Tc

### Subcatchment 3S: Post Const. RunoffSubarea B LT Ditch #1



**Deer Run B\_LT1**

Type II 24-hr Rainfall=2.20"

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**Hydrograph for Subcatchment 3S: Post Const. RunoffSubarea B LT Ditch #1**

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)	Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
5.00	0.14	0.00	0.00	16.50	1.96	0.72	0.01
5.25	0.15	0.00	0.00	16.75	1.97	0.72	0.01
5.50	0.16	0.00	0.00	17.00	1.98	0.73	0.01
5.75	0.17	0.00	0.00	17.25	1.99	0.74	0.00
6.00	0.18	0.00	0.00	17.50	2.01	0.75	0.00
6.25	0.19	0.00	0.00	17.75	2.02	0.76	0.00
6.50	0.20	0.00	0.00	18.00	2.03	0.76	0.00
6.75	0.21	0.00	0.00	18.25	2.04	0.77	0.00
7.00	0.22	0.00	0.00	18.50	2.05	0.78	0.00
7.25	0.23	0.00	0.00	18.75	2.05	0.78	0.00
7.50	0.24	0.00	0.00	19.00	2.06	0.79	0.00
7.75	0.25	0.00	0.00	19.25	2.07	0.79	0.00
8.00	0.26	0.00	0.00	19.50	2.08	0.80	0.00
8.25	0.28	0.00	0.00	19.75	2.09	0.81	0.00
8.50	0.29	0.00	0.00	20.00	<b>2.09</b>	<b>0.81</b>	0.00
8.75	0.31	0.00	0.00				
9.00	0.32	0.00	0.00				
9.25	0.34	0.00	0.00				
9.50	0.36	0.00	0.00				
9.75	0.38	0.00	0.00				
10.00	0.40	0.00	0.00				
10.25	0.42	0.00	0.00				
10.50	0.45	0.00	0.00				
10.75	0.48	0.00	0.00				
11.00	0.52	0.01	0.00				
11.25	0.56	0.02	0.00				
11.50	0.62	0.03	0.01				
11.75	0.85	0.09	0.03				
12.00	1.46	0.39	<b>0.20</b>				
12.25	1.55	0.45	0.05				
12.50	1.62	0.49	0.03				
12.75	1.66	0.51	0.02				
13.00	1.70	0.54	0.02				
13.25	1.73	0.56	0.01				
13.50	1.76	0.58	0.01				
13.75	1.78	0.59	0.01				
14.00	1.80	0.61	0.01				
14.25	1.82	0.62	0.01				
14.50	1.84	0.63	0.01				
14.75	1.86	0.65	0.01				
15.00	1.88	0.66	0.01				
15.25	1.89	0.67	0.01				
15.50	1.91	0.68	0.01				
15.75	1.92	0.69	0.01				
16.00	1.94	0.70	0.01				
16.25	1.95	0.71	0.01				

## Deer Run B\_LT1

Type II 24-hr Rainfall=2.20"

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### Summary for Reach 4R: Biofilter

Inflow Area = 0.154 ac, 0.00% Impervious, Inflow Depth > 0.81"  
Inflow = 0.20 cfs @ 12.02 hrs, Volume= 0.010 af  
Outflow = 0.19 cfs @ 12.10 hrs, Volume= 0.010 af, Atten= 5%, Lag= 4.6 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Max. Velocity= 1.21 fps, Min. Travel Time= 2.8 min  
Avg. Velocity = 0.66 fps, Avg. Travel Time= 5.0 min

Peak Storage= 33 cf @ 12.05 hrs  
Average Depth at Peak Storage= 0.04'  
Bank-Full Depth= 1.55' Flow Area= 15.8 sf, Capacity= 160.00 cfs

4.00' x 1.55' deep channel, n= 0.030  
Side Slope Z-value= 4.0 ' ' Top Width= 16.40'  
Length= 200.0' Slope= 0.0452 ' '  
Inlet Invert= 856.54', Outlet Invert= 847.50'



## Deer Run B\_LT1

Type II 24-hr Rainfall=2.20"

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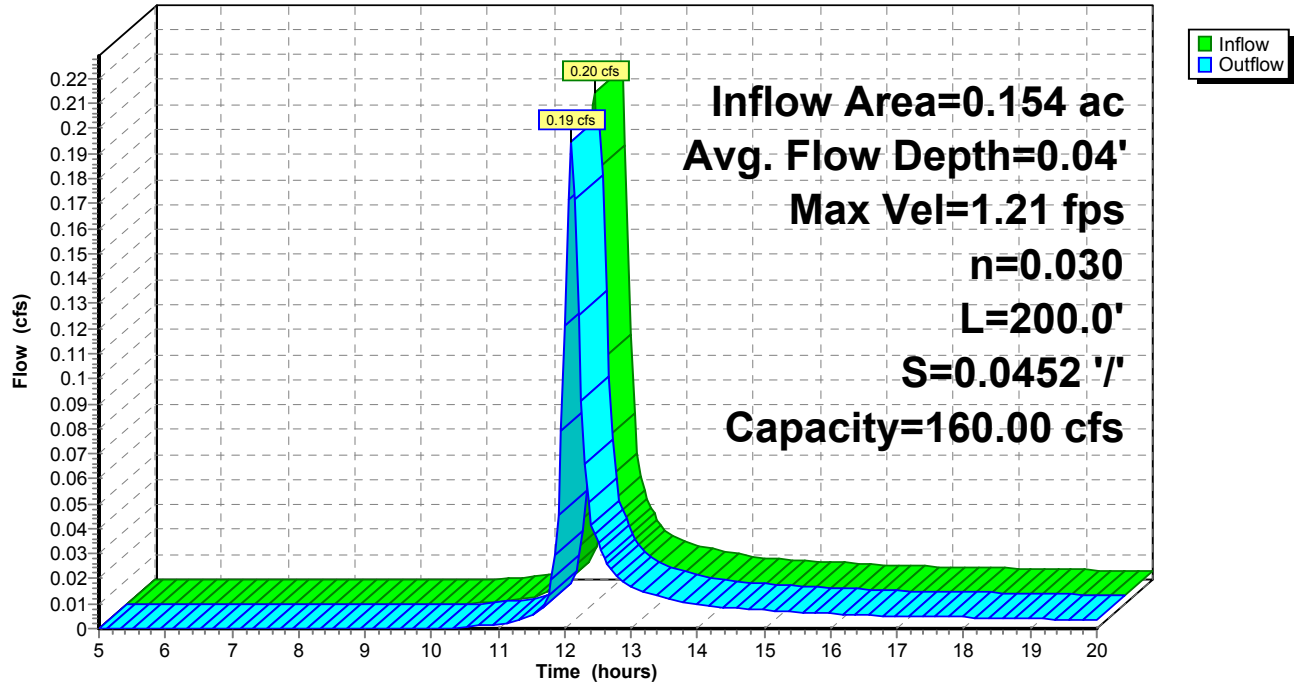
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### Reach 4R: Biofilter

#### Hydrograph





**Deer Run B\_LT1***Type II 24-hr Rainfall=2.20"*Prepared by HydroCAD SAMPLER 1-800-927-7246 [www.hydrocad.net](http://www.hydrocad.net)

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**Hydrograph for Reach 4R: Biofilter**

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Outflow (cfs)
5.00	0.00	0	856.54	0.00
5.50	0.00	0	856.54	0.00
6.00	0.00	0	856.54	0.00
6.50	0.00	0	856.54	0.00
7.00	0.00	0	856.54	0.00
7.50	0.00	0	856.54	0.00
8.00	0.00	0	856.54	0.00
8.50	0.00	0	856.54	0.00
9.00	0.00	0	856.54	0.00
9.50	0.00	0	856.54	0.00
10.00	0.00	0	856.54	0.00
10.50	0.00	0	856.54	0.00
11.00	0.00	1	856.54	0.00
11.50	0.01	2	856.54	0.01
12.00	<b>0.20</b>	<b>30</b>	<b>856.58</b>	<b>0.12</b>
12.50	0.03	<b>10</b>	<b>856.55</b>	<b>0.03</b>
13.00	0.02	5	856.55	0.02
13.50	0.01	4	856.54	0.01
14.00	0.01	3	856.54	0.01
14.50	0.01	3	856.54	0.01
15.00	0.01	2	856.54	0.01
15.50	0.01	2	856.54	0.01
16.00	0.01	2	856.54	0.01
16.50	0.01	2	856.54	0.01
17.00	0.01	2	856.54	0.01
17.50	0.00	1	856.54	0.00
18.00	0.00	1	856.54	0.00
18.50	0.00	1	856.54	0.00
19.00	0.00	1	856.54	0.00
19.50	0.00	1	856.54	0.00
20.00	0.00	1	856.54	0.00

## Deer Run B\_LT2

Type II 24-hr Rainfall=2.20"

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### Summary for Subcatchment 1S: Pre Const. Runoff Subarea B Lt Ditch #2

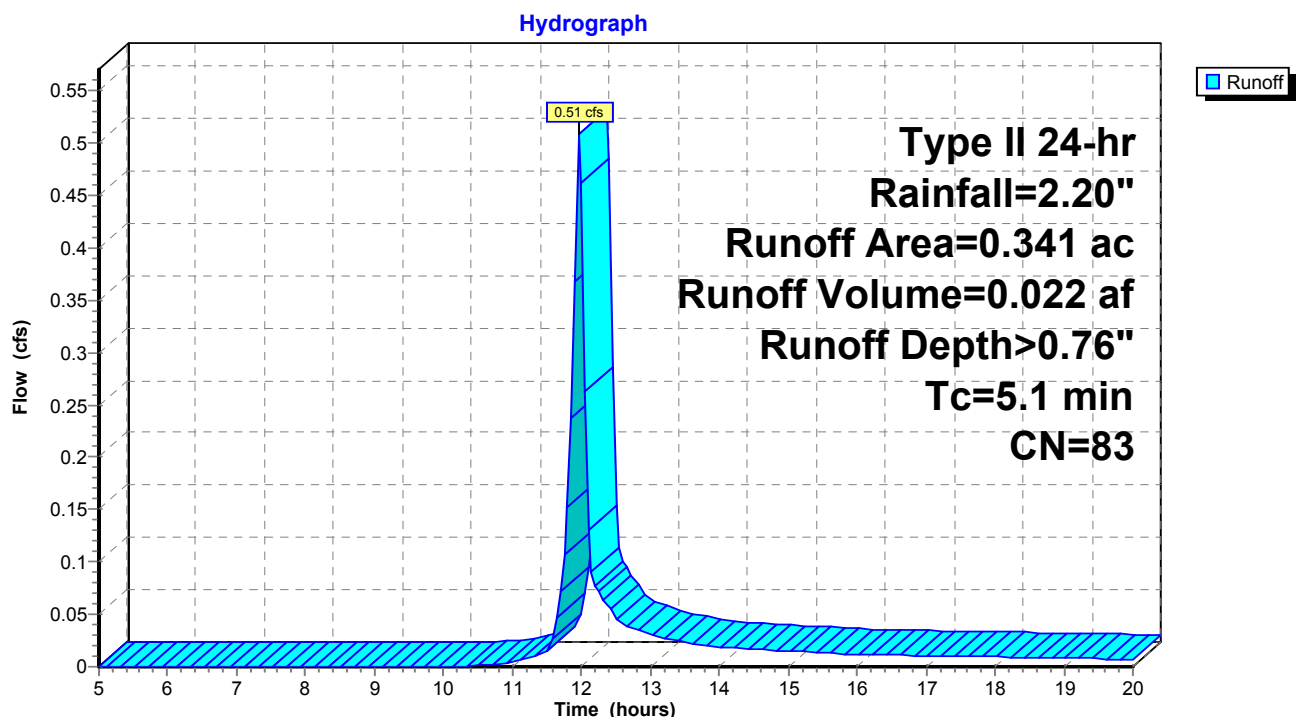
Runoff = 0.51 cfs @ 11.96 hrs, Volume= 0.022 af, Depth> 0.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Type II 24-hr Rainfall=2.20"

Area (ac)	CN	Description
0.341	83	Woods, Poor, HSG D
0.341		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1					Direct Entry,

### Subcatchment 1S: Pre Const. Runoff Subarea B Lt Ditch #2



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**Hydrograph for Subcatchment 1S: Pre Const. Runoff Subarea B Lt Ditch #2**

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)	Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
5.00	0.14	0.00	0.00	16.50	1.96	0.67	0.01
5.25	0.15	0.00	0.00	16.75	1.97	0.68	0.01
5.50	0.16	0.00	0.00	17.00	1.98	0.68	0.01
5.75	0.17	0.00	0.00	17.25	1.99	0.69	0.01
6.00	0.18	0.00	0.00	17.50	2.01	0.70	0.01
6.25	0.19	0.00	0.00	17.75	2.02	0.71	0.01
6.50	0.20	0.00	0.00	18.00	2.03	0.71	0.01
6.75	0.21	0.00	0.00	18.25	2.04	0.72	0.01
7.00	0.22	0.00	0.00	18.50	2.05	0.73	0.01
7.25	0.23	0.00	0.00	18.75	2.05	0.73	0.01
7.50	0.24	0.00	0.00	19.00	2.06	0.74	0.01
7.75	0.25	0.00	0.00	19.25	2.07	0.74	0.01
8.00	0.26	0.00	0.00	19.50	2.08	0.75	0.01
8.25	0.28	0.00	0.00	19.75	2.09	0.76	0.01
8.50	0.29	0.00	0.00	20.00	<b>2.09</b>	<b>0.76</b>	0.01
8.75	0.31	0.00	0.00				
9.00	0.32	0.00	0.00				
9.25	0.34	0.00	0.00				
9.50	0.36	0.00	0.00				
9.75	0.38	0.00	0.00				
10.00	0.40	0.00	0.00				
10.25	0.42	0.00	0.00				
10.50	0.45	0.00	0.00				
10.75	0.48	0.00	0.00				
11.00	0.52	0.01	0.00				
11.25	0.56	0.01	0.01				
11.50	0.62	0.02	0.01				
11.75	0.85	0.08	<b>0.11</b>				
12.00	1.46	0.36	<b>0.46</b>				
12.25	1.55	0.41	0.07				
12.50	1.62	0.45	0.05				
12.75	1.66	0.47	0.04				
13.00	1.70	0.50	0.03				
13.25	1.73	0.52	0.03				
13.50	1.76	0.54	0.02				
13.75	1.78	0.55	0.02				
14.00	1.80	0.56	0.02				
14.25	1.82	0.58	0.02				
14.50	1.84	0.59	0.02				
14.75	1.86	0.60	0.02				
15.00	1.88	0.61	0.02				
15.25	1.89	0.62	0.01				
15.50	1.91	0.63	0.01				
15.75	1.92	0.64	0.01				
16.00	1.94	0.65	0.01				
16.25	1.95	0.66	0.01				

## Deer Run B\_LT2

Type II 24-hr Rainfall=2.20"

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### Summary for Subcatchment 3S: Post Const. Runoff Subarea B LT Ditch #2

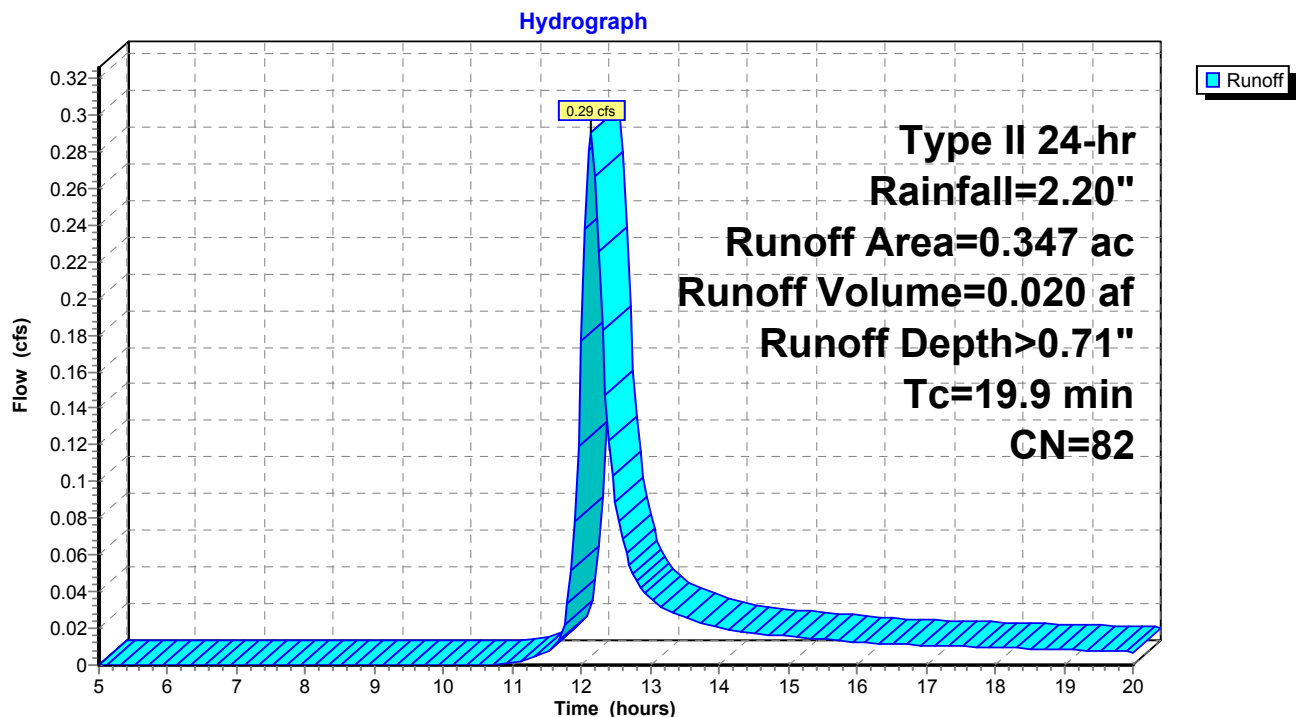
Runoff = 0.29 cfs @ 12.14 hrs, Volume= 0.020 af, Depth> 0.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Type II 24-hr Rainfall=2.20"

Area (ac)	CN	Description
0.026	77	Woods, Good, HSG D
0.149	85	Gravel roads, HSG B
0.172	80	>75% Grass cover, Good, HSG D
0.347	82	Weighted Average
0.347		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.9					Direct Entry, Tc

### Subcatchment 3S: Post Const. Runoff Subarea B LT Ditch #2



**Deer Run B\_LT2***Type II 24-hr Rainfall=2.20"*Prepared by HydroCAD SAMPLER 1-800-927-7246 [www.hydrocad.net](http://www.hydrocad.net)

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**Hydrograph for Subcatchment 3S: Post Const. Runoff Subarea B LT Ditch #2**

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)	Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
5.00	0.14	0.00	0.00	16.50	1.96	0.62	0.01
5.25	0.15	0.00	0.00	16.75	1.97	0.63	0.01
5.50	0.16	0.00	0.00	17.00	1.98	0.64	0.01
5.75	0.17	0.00	0.00	17.25	1.99	0.65	0.01
6.00	0.18	0.00	0.00	17.50	2.01	0.65	0.01
6.25	0.19	0.00	0.00	17.75	2.02	0.66	0.01
6.50	0.20	0.00	0.00	18.00	2.03	0.67	0.01
6.75	0.21	0.00	0.00	18.25	2.04	0.67	0.01
7.00	0.22	0.00	0.00	18.50	2.05	0.68	0.01
7.25	0.23	0.00	0.00	18.75	2.05	0.68	0.01
7.50	0.24	0.00	0.00	19.00	2.06	0.69	0.01
7.75	0.25	0.00	0.00	19.25	2.07	0.70	0.01
8.00	0.26	0.00	0.00	19.50	2.08	0.70	0.01
8.25	0.28	0.00	0.00	19.75	2.09	0.71	0.01
8.50	0.29	0.00	0.00	20.00	<b>2.09</b>	<b>0.71</b>	0.01
8.75	0.31	0.00	0.00				
9.00	0.32	0.00	0.00				
9.25	0.34	0.00	0.00				
9.50	0.36	0.00	0.00				
9.75	0.38	0.00	0.00				
10.00	0.40	0.00	0.00				
10.25	0.42	0.00	0.00				
10.50	0.45	0.00	0.00				
10.75	0.48	0.00	0.00				
11.00	0.52	0.00	0.00				
11.25	0.56	0.01	0.00				
11.50	0.62	0.01	0.01				
11.75	0.85	0.07	0.02				
12.00	1.46	0.32	<b>0.18</b>				
12.25	1.55	0.38	<b>0.23</b>				
12.50	1.62	0.41	0.09				
12.75	1.66	0.44	0.05				
13.00	1.70	0.46	0.04				
13.25	1.73	0.48	0.03				
13.50	1.76	0.49	0.03				
13.75	1.78	0.51	0.02				
14.00	1.80	0.52	0.02				
14.25	1.82	0.54	0.02				
14.50	1.84	0.55	0.02				
14.75	1.86	0.56	0.02				
15.00	1.88	0.57	0.02				
15.25	1.89	0.58	0.01				
15.50	1.91	0.59	0.01				
15.75	1.92	0.60	0.01				
16.00	1.94	0.61	0.01				
16.25	1.95	0.62	0.01				

## Deer Run B\_LT2

Type II 24-hr Rainfall=2.20"

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### Summary for Reach 4R: Biofilter

Inflow Area = 0.347 ac, 0.00% Impervious, Inflow Depth > 0.71"  
Inflow = 0.29 cfs @ 12.14 hrs, Volume= 0.020 af  
Outflow = 0.27 cfs @ 12.30 hrs, Volume= 0.020 af, Atten= 9%, Lag= 9.6 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Max. Velocity= 1.26 fps, Min. Travel Time= 5.7 min  
Avg. Velocity = 0.62 fps, Avg. Travel Time= 11.6 min

Peak Storage= 91 cf @ 12.20 hrs  
Average Depth at Peak Storage= 0.05'  
Bank-Full Depth= 1.55' Flow Area= 15.8 sf, Capacity= 143.58 cfs

4.00' x 1.55' deep channel, n= 0.030  
Side Slope Z-value= 4.0 ' ' Top Width= 16.40'  
Length= 430.0' Slope= 0.0364 ' '  
Inlet Invert= 856.54', Outlet Invert= 840.89'



## Deer Run B\_LT2

Type II 24-hr Rainfall=2.20"

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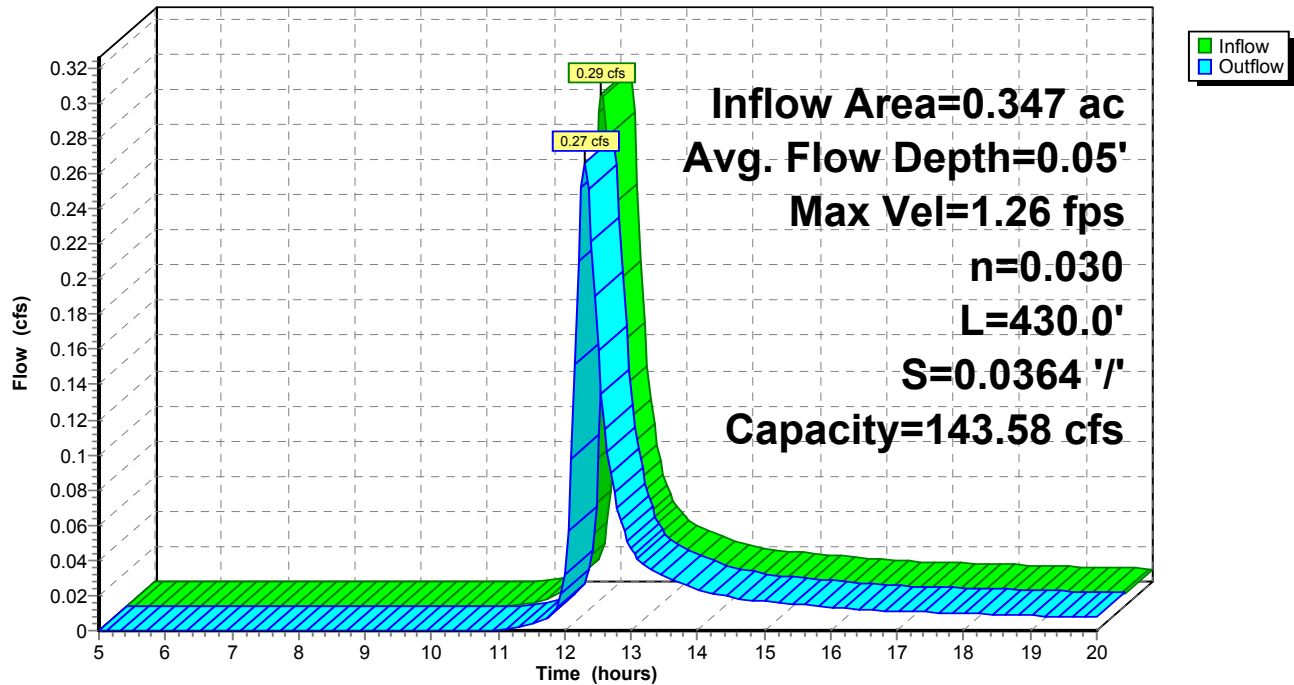
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### Reach 4R: Biofilter

#### Hydrograph



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**Hydrograph for Reach 4R: Biofilter**

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Outflow (cfs)
5.00	0.00	0	856.54	0.00
5.50	0.00	0	856.54	0.00
6.00	0.00	0	856.54	0.00
6.50	0.00	0	856.54	0.00
7.00	0.00	0	856.54	0.00
7.50	0.00	0	856.54	0.00
8.00	0.00	0	856.54	0.00
8.50	0.00	0	856.54	0.00
9.00	0.00	0	856.54	0.00
9.50	0.00	0	856.54	0.00
10.00	0.00	0	856.54	0.00
10.50	0.00	0	856.54	0.00
11.00	0.00	1	856.54	0.00
11.50	0.01	3	856.54	0.00
12.00	<b>0.18</b>	<b>46</b>	<b>856.57</b>	<b>0.03</b>
12.50	<b>0.09</b>	<b>55</b>	<b>856.57</b>	<b>0.16</b>
13.00	0.04	29	856.56	0.05
13.50	0.03	22	856.55	0.03
14.00	0.02	17	856.55	0.02
14.50	0.02	14	856.55	0.02
15.00	0.02	12	856.55	0.02
15.50	0.01	11	856.55	0.02
16.00	0.01	10	856.55	0.01
16.50	0.01	9	856.54	0.01
17.00	0.01	8	856.54	0.01
17.50	0.01	8	856.54	0.01
18.00	0.01	7	856.54	0.01
18.50	0.01	7	856.54	0.01
19.00	0.01	6	856.54	0.01
19.50	0.01	6	856.54	0.01
20.00	0.01	5	856.54	0.01



## Deer Run B\_Rt1

Type II 24-hr Rainfall=2.20"

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### Summary for Subcatchment 1S: Area B - Pre Constr. RT Ditch #1

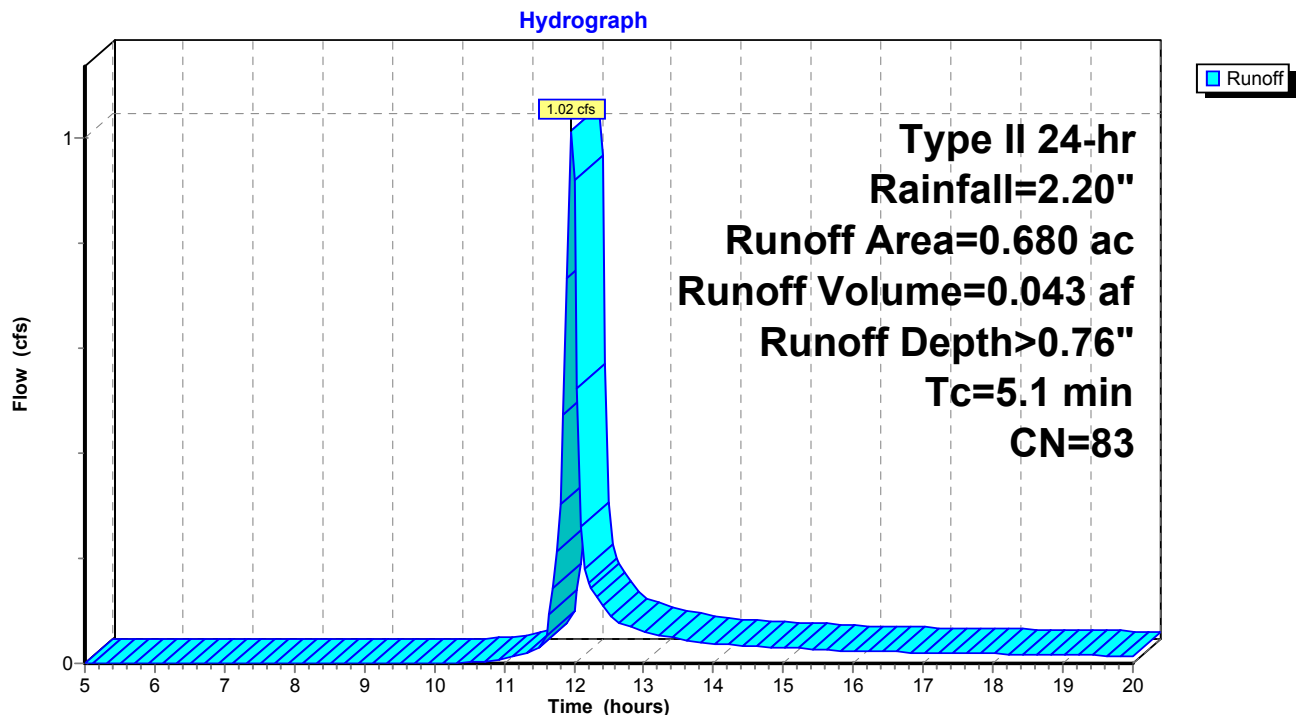
Runoff = 1.02 cfs @ 11.96 hrs, Volume= 0.043 af, Depth> 0.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Type II 24-hr Rainfall=2.20"

Area (ac)	CN	Description
0.658	83	Woods, Poor, HSG D
0.022	91	Gravel roads, HSG D
0.680	83	Weighted Average
0.680		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1					Direct Entry,

### Subcatchment 1S: Area B - Pre Constr. RT Ditch #1



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**Hydrograph for Subcatchment 1S: Area B - Pre Constr. RT Ditch #1**

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)	Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
5.00	0.14	0.00	0.00	16.50	1.96	0.67	0.02
5.25	0.15	0.00	0.00	16.75	1.97	0.68	0.02
5.50	0.16	0.00	0.00	17.00	1.98	0.68	0.02
5.75	0.17	0.00	0.00	17.25	1.99	0.69	0.02
6.00	0.18	0.00	0.00	17.50	2.01	0.70	0.02
6.25	0.19	0.00	0.00	17.75	2.02	0.71	0.02
6.50	0.20	0.00	0.00	18.00	2.03	0.71	0.02
6.75	0.21	0.00	0.00	18.25	2.04	0.72	0.02
7.00	0.22	0.00	0.00	18.50	2.05	0.73	0.02
7.25	0.23	0.00	0.00	18.75	2.05	0.73	0.02
7.50	0.24	0.00	0.00	19.00	2.06	0.74	0.02
7.75	0.25	0.00	0.00	19.25	2.07	0.74	0.02
8.00	0.26	0.00	0.00	19.50	2.08	0.75	0.02
8.25	0.28	0.00	0.00	19.75	2.09	0.76	0.01
8.50	0.29	0.00	0.00	20.00	<b>2.09</b>	<b>0.76</b>	0.01
8.75	0.31	0.00	0.00				
9.00	0.32	0.00	0.00				
9.25	0.34	0.00	0.00				
9.50	0.36	0.00	0.00				
9.75	0.38	0.00	0.00				
10.00	0.40	0.00	0.00				
10.25	0.42	0.00	0.00				
10.50	0.45	0.00	0.00				
10.75	0.48	0.00	0.00				
11.00	0.52	0.01	0.01				
11.25	0.56	0.01	0.02				
11.50	0.62	0.02	0.03				
11.75	0.85	0.08	<b>0.21</b>				
12.00	1.46	0.36	<b>0.92</b>				
12.25	1.55	0.41	0.14				
12.50	1.62	0.45	0.09				
12.75	1.66	0.47	0.07				
13.00	1.70	0.50	0.06				
13.25	1.73	0.52	0.05				
13.50	1.76	0.54	0.05				
13.75	1.78	0.55	0.04				
14.00	1.80	0.56	0.04				
14.25	1.82	0.58	0.04				
14.50	1.84	0.59	0.03				
14.75	1.86	0.60	0.03				
15.00	1.88	0.61	0.03				
15.25	1.89	0.62	0.03				
15.50	1.91	0.63	0.03				
15.75	1.92	0.64	0.03				
16.00	1.94	0.65	0.02				
16.25	1.95	0.66	0.02				

## Deer Run B\_Rt1

Type II 24-hr Rainfall=2.20"

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### Summary for Subcatchment 3S: Area B - Post Constr. RT Ditch #1

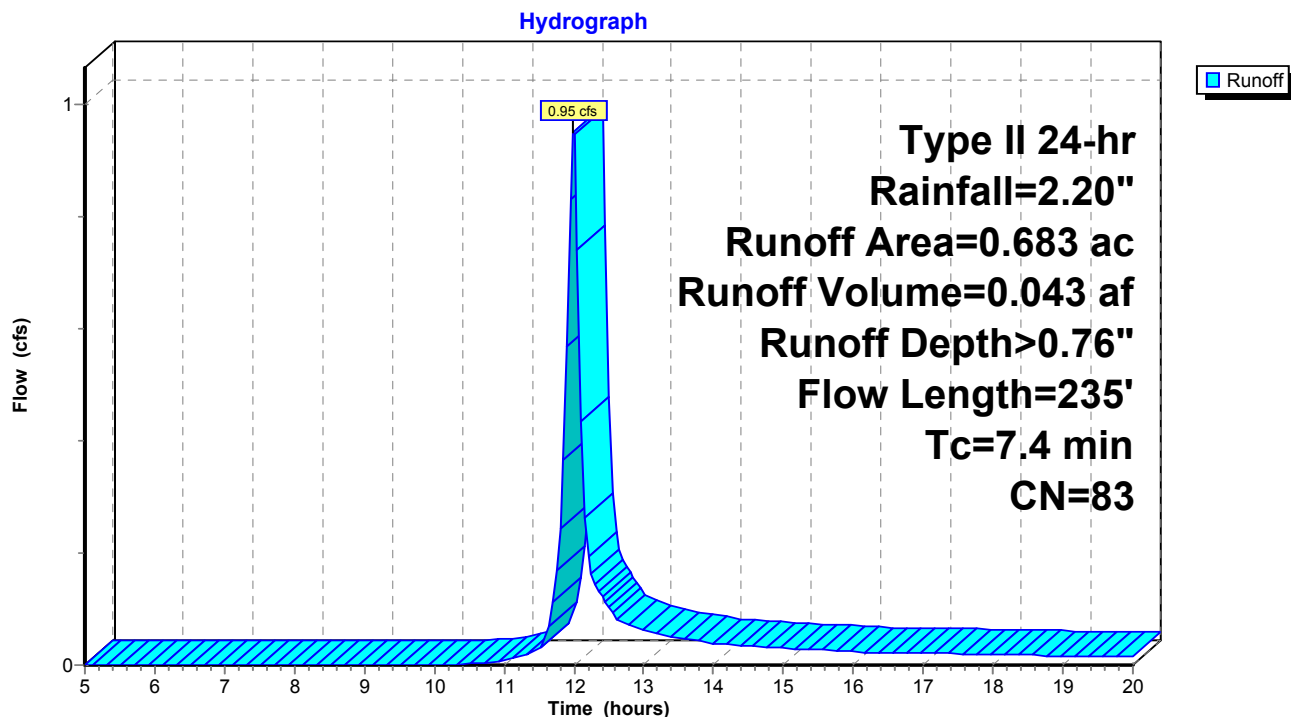
Runoff = 0.95 cfs @ 11.99 hrs, Volume= 0.043 af, Depth> 0.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Type II 24-hr Rainfall=2.20"

Area (ac)	CN	Description
0.160	80	>75% Grass cover, Good, HSG D
0.083	91	Gravel roads, HSG D
0.440	83	Woods, Poor, HSG D
0.683	83	Weighted Average
0.683		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.4	235		0.53		Direct Entry, Tc

### Subcatchment 3S: Area B - Post Constr. RT Ditch #1



**Deer Run B\_Rt1**

Type II 24-hr Rainfall=2.20"

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**Hydrograph for Subcatchment 3S: Area B - Post Constr. RT Ditch #1**

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)	Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
5.00	0.14	0.00	0.00	16.50	1.96	0.67	0.02
5.25	0.15	0.00	0.00	16.75	1.97	0.68	0.02
5.50	0.16	0.00	0.00	17.00	1.98	0.68	0.02
5.75	0.17	0.00	0.00	17.25	1.99	0.69	0.02
6.00	0.18	0.00	0.00	17.50	2.01	0.70	0.02
6.25	0.19	0.00	0.00	17.75	2.02	0.71	0.02
6.50	0.20	0.00	0.00	18.00	2.03	0.71	0.02
6.75	0.21	0.00	0.00	18.25	2.04	0.72	0.02
7.00	0.22	0.00	0.00	18.50	2.05	0.73	0.02
7.25	0.23	0.00	0.00	18.75	2.05	0.73	0.02
7.50	0.24	0.00	0.00	19.00	2.06	0.74	0.02
7.75	0.25	0.00	0.00	19.25	2.07	0.74	0.02
8.00	0.26	0.00	0.00	19.50	2.08	0.75	0.02
8.25	0.28	0.00	0.00	19.75	2.09	0.76	0.01
8.50	0.29	0.00	0.00	20.00	<b>2.09</b>	<b>0.76</b>	0.01
8.75	0.31	0.00	0.00				
9.00	0.32	0.00	0.00				
9.25	0.34	0.00	0.00				
9.50	0.36	0.00	0.00				
9.75	0.38	0.00	0.00				
10.00	0.40	0.00	0.00				
10.25	0.42	0.00	0.00				
10.50	0.45	0.00	0.00				
10.75	0.48	0.00	0.00				
11.00	0.52	0.01	0.01				
11.25	0.56	0.01	0.02				
11.50	0.62	0.02	0.03				
11.75	0.85	0.08	0.17				
12.00	1.46	0.36	<b>0.95</b>				
12.25	1.55	0.41	0.16				
12.50	1.62	0.45	0.10				
12.75	1.66	0.47	0.07				
13.00	1.70	0.50	0.06				
13.25	1.73	0.52	0.05				
13.50	1.76	0.54	0.05				
13.75	1.78	0.55	0.04				
14.00	1.80	0.56	0.04				
14.25	1.82	0.58	0.04				
14.50	1.84	0.59	0.03				
14.75	1.86	0.60	0.03				
15.00	1.88	0.61	0.03				
15.25	1.89	0.62	0.03				
15.50	1.91	0.63	0.03				
15.75	1.92	0.64	0.03				
16.00	1.94	0.65	0.02				
16.25	1.95	0.66	0.02				

## Deer Run B\_Rt1

Type II 24-hr Rainfall=2.20"

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### Summary for Reach 4R: Biofilter

Inflow Area = 0.683 ac, 0.00% Impervious, Inflow Depth > 0.76"  
Inflow = 0.95 cfs @ 11.99 hrs, Volume= 0.043 af  
Outflow = 0.89 cfs @ 12.03 hrs, Volume= 0.043 af, Atten= 7%, Lag= 2.3 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Max. Velocity= 2.13 fps, Min. Travel Time= 1.4 min  
Avg. Velocity = 0.73 fps, Avg. Travel Time= 4.0 min

Peak Storage= 76 cf @ 12.01 hrs  
Average Depth at Peak Storage= 0.10'  
Bank-Full Depth= 1.55' Flow Area= 15.8 sf, Capacity= 160.00 cfs

4.00' x 1.55' deep channel, n= 0.030  
Side Slope Z-value= 4.0 ' ' Top Width= 16.40'  
Length= 175.0' Slope= 0.0452 ' '  
Inlet Invert= 856.54', Outlet Invert= 848.63'



## Deer Run B\_Rt1

Type II 24-hr Rainfall=2.20"

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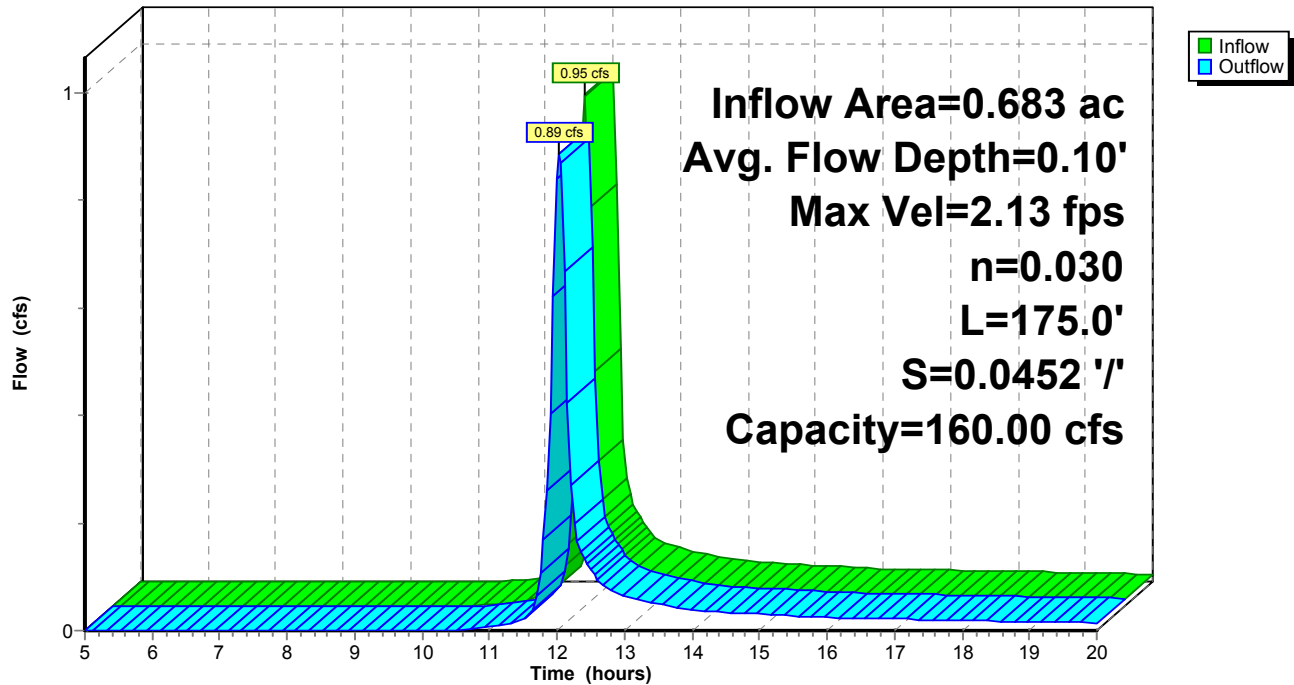
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### Reach 4R: Biofilter

#### Hydrograph



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**Hydrograph for Reach 4R: Biofilter**

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Outflow (cfs)
5.00	0.00	0	856.54	0.00
5.50	0.00	0	856.54	0.00
6.00	0.00	0	856.54	0.00
6.50	0.00	0	856.54	0.00
7.00	0.00	0	856.54	0.00
7.50	0.00	0	856.54	0.00
8.00	0.00	0	856.54	0.00
8.50	0.00	0	856.54	0.00
9.00	0.00	0	856.54	0.00
9.50	0.00	0	856.54	0.00
10.00	0.00	0	856.54	0.00
10.50	0.00	0	856.54	0.00
11.00	0.01	2	856.54	0.01
11.50	0.03	6	856.55	0.02
12.00	<b>0.95</b>	<b>76</b>	<b>856.64</b>	<b>0.84</b>
12.50	0.10	20	856.57	<b>0.11</b>
13.00	0.06	14	856.56	0.07
13.50	0.05	12	856.56	0.05
14.00	0.04	11	856.56	0.04
14.50	0.03	9	856.55	0.03
15.00	0.03	8	856.55	0.03
15.50	0.03	8	856.55	0.03
16.00	0.02	7	856.55	0.02
16.50	0.02	6	856.55	0.02
17.00	0.02	6	856.55	0.02
17.50	0.02	6	856.55	0.02
18.00	0.02	5	856.55	0.02
18.50	0.02	5	856.55	0.02
19.00	0.02	5	856.55	0.02
19.50	0.02	4	856.55	0.02
20.00	0.01	4	856.55	0.01

## Deer Run B\_RT2

Type II 24-hr Rainfall=2.20"

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### Summary for Subcatchment 1S: Pre Const. Runoff Subarea B Rt Ditch #2

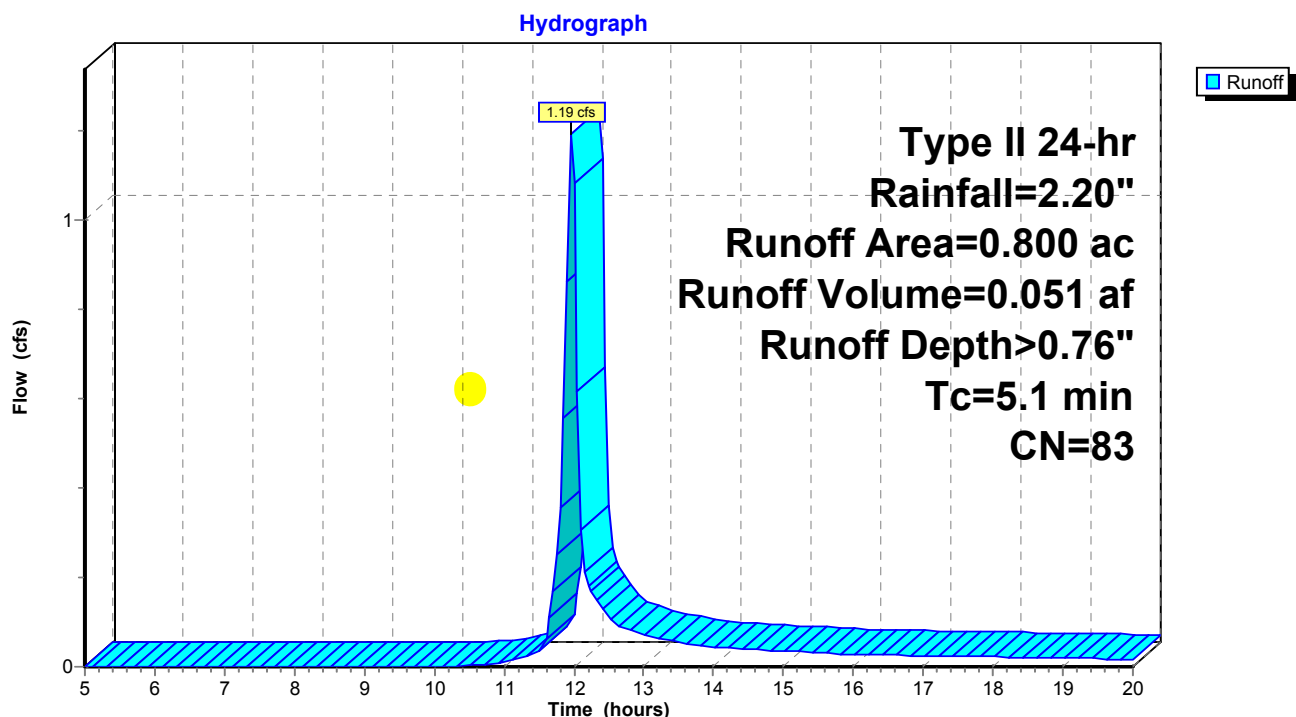
Runoff = 1.19 cfs @ 11.96 hrs, Volume= 0.051 af, Depth> 0.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Type II 24-hr Rainfall=2.20"

Area (ac)	CN	Description
0.800	83	Woods, Poor, HSG D
0.800		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1					Direct Entry,

### Subcatchment 1S: Pre Const. Runoff Subarea B Rt Ditch #2





**Deer Run B\_RT2***Type II 24-hr Rainfall=2.20"*Prepared by HydroCAD SAMPLER 1-800-927-7246 [www.hydrocad.net](http://www.hydrocad.net)

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**Hydrograph for Subcatchment 1S: Pre Const. Runoff Subarea B Rt Ditch #2**

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)	Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
5.00	0.14	0.00	0.00	16.50	1.96	0.67	0.03
5.25	0.15	0.00	0.00	16.75	1.97	0.68	0.03
5.50	0.16	0.00	0.00	17.00	1.98	0.68	0.02
5.75	0.17	0.00	0.00	17.25	1.99	0.69	0.02
6.00	0.18	0.00	0.00	17.50	2.01	0.70	0.02
6.25	0.19	0.00	0.00	17.75	2.02	0.71	0.02
6.50	0.20	0.00	0.00	18.00	2.03	0.71	0.02
6.75	0.21	0.00	0.00	18.25	2.04	0.72	0.02
7.00	0.22	0.00	0.00	18.50	2.05	0.73	0.02
7.25	0.23	0.00	0.00	18.75	2.05	0.73	0.02
7.50	0.24	0.00	0.00	19.00	2.06	0.74	0.02
7.75	0.25	0.00	0.00	19.25	2.07	0.74	0.02
8.00	0.26	0.00	0.00	19.50	2.08	0.75	0.02
8.25	0.28	0.00	0.00	19.75	2.09	0.76	0.02
8.50	0.29	0.00	0.00	20.00	<b>2.09</b>	<b>0.76</b>	0.02
8.75	0.31	0.00	0.00				
9.00	0.32	0.00	0.00				
9.25	0.34	0.00	0.00				
9.50	0.36	0.00	0.00				
9.75	0.38	0.00	0.00				
10.00	0.40	0.00	0.00				
10.25	0.42	0.00	0.00				
10.50	0.45	0.00	0.00				
10.75	0.48	0.00	0.01				
11.00	0.52	0.01	0.01				
11.25	0.56	0.01	0.02				
11.50	0.62	0.02	0.03				
11.75	0.85	0.08	<b>0.25</b>				
12.00	1.46	0.36	<b>1.08</b>				
12.25	1.55	0.41	0.17				
12.50	1.62	0.45	0.11				
12.75	1.66	0.47	0.08				
13.00	1.70	0.50	0.07				
13.25	1.73	0.52	0.06				
13.50	1.76	0.54	0.06				
13.75	1.78	0.55	0.05				
14.00	1.80	0.56	0.04				
14.25	1.82	0.58	0.04				
14.50	1.84	0.59	0.04				
14.75	1.86	0.60	0.04				
15.00	1.88	0.61	0.04				
15.25	1.89	0.62	0.03				
15.50	1.91	0.63	0.03				
15.75	1.92	0.64	0.03				
16.00	1.94	0.65	0.03				
16.25	1.95	0.66	0.03				

## Deer Run B\_RT2

Type II 24-hr Rainfall=2.20"

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### Summary for Subcatchment 3S: Post Const. Runoff Subarea B Ditch #2

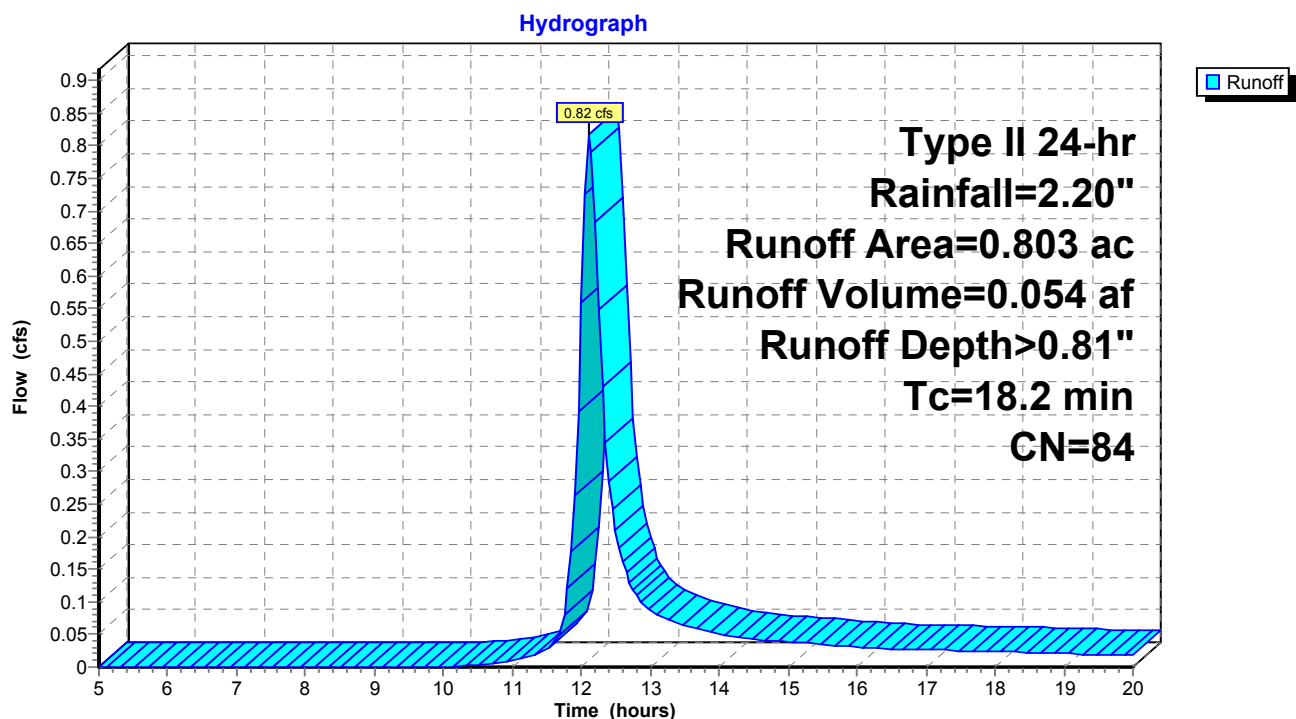
Runoff = 0.82 cfs @ 12.11 hrs, Volume= 0.054 af, Depth> 0.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Type II 24-hr Rainfall=2.20"

Area (ac)	CN	Description
0.391	83	Woods, Poor, HSG D
0.180	91	Gravel roads, HSG D
0.232	80	>75% Grass cover, Good, HSG D
0.803	84	Weighted Average
0.803		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.2					Direct Entry, Tc

### Subcatchment 3S: Post Const. Runoff Subarea B Ditch #2



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**Hydrograph for Subcatchment 3S: Post Const. Runoff Subarea B Ditch #2**

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)	Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
5.00	0.14	0.00	0.00	16.50	1.96	0.72	0.03
5.25	0.15	0.00	0.00	16.75	1.97	0.72	0.03
5.50	0.16	0.00	0.00	17.00	1.98	0.73	0.03
5.75	0.17	0.00	0.00	17.25	1.99	0.74	0.03
6.00	0.18	0.00	0.00	17.50	2.01	0.75	0.03
6.25	0.19	0.00	0.00	17.75	2.02	0.76	0.02
6.50	0.20	0.00	0.00	18.00	2.03	0.76	0.02
6.75	0.21	0.00	0.00	18.25	2.04	0.77	0.02
7.00	0.22	0.00	0.00	18.50	2.05	0.78	0.02
7.25	0.23	0.00	0.00	18.75	2.05	0.78	0.02
7.50	0.24	0.00	0.00	19.00	2.06	0.79	0.02
7.75	0.25	0.00	0.00	19.25	2.07	0.79	0.02
8.00	0.26	0.00	0.00	19.50	2.08	0.80	0.02
8.25	0.28	0.00	0.00	19.75	2.09	0.81	0.02
8.50	0.29	0.00	0.00	20.00	<b>2.09</b>	<b>0.81</b>	0.02
8.75	0.31	0.00	0.00				
9.00	0.32	0.00	0.00				
9.25	0.34	0.00	0.00				
9.50	0.36	0.00	0.00				
9.75	0.38	0.00	0.00				
10.00	0.40	0.00	0.00				
10.25	0.42	0.00	0.00				
10.50	0.45	0.00	0.00				
10.75	0.48	0.00	0.01				
11.00	0.52	0.01	0.01				
11.25	0.56	0.02	0.02				
11.50	0.62	0.03	0.03				
11.75	0.85	0.09	0.08				
12.00	1.46	0.39	<b>0.56</b>				
12.25	1.55	0.45	<b>0.55</b>				
12.50	1.62	0.49	0.21				
12.75	1.66	0.51	0.12				
13.00	1.70	0.54	0.09				
13.25	1.73	0.56	0.07				
13.50	1.76	0.58	0.06				
13.75	1.78	0.59	0.06				
14.00	1.80	0.61	0.05				
14.25	1.82	0.62	0.05				
14.50	1.84	0.63	0.04				
14.75	1.86	0.65	0.04				
15.00	1.88	0.66	0.04				
15.25	1.89	0.67	0.04				
15.50	1.91	0.68	0.03				
15.75	1.92	0.69	0.03				
16.00	1.94	0.70	0.03				
16.25	1.95	0.71	0.03				

## Deer Run B\_RT2

Type II 24-hr Rainfall=2.20"

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### Summary for Reach 4R: Biofilter

Inflow Area = 0.803 ac, 0.00% Impervious, Inflow Depth > 0.81"  
Inflow = 0.82 cfs @ 12.11 hrs, Volume= 0.054 af  
Outflow = 0.75 cfs @ 12.25 hrs, Volume= 0.053 af, Atten= 8%, Lag= 7.9 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Max. Velocity= 1.85 fps, Min. Travel Time= 4.6 min  
Avg. Velocity = 0.69 fps, Avg. Travel Time= 12.4 min

Peak Storage= 213 cf @ 12.17 hrs  
Average Depth at Peak Storage= 0.09'  
Bank-Full Depth= 1.55' Flow Area= 15.8 sf, Capacity= 143.60 cfs

4.00' x 1.55' deep channel, n= 0.030  
Side Slope Z-value= 4.0 ' ' Top Width= 16.40'  
Length= 515.0' Slope= 0.0364 ' '  
Inlet Invert= 856.54', Outlet Invert= 837.79'



## Deer Run B\_RT2

Type II 24-hr Rainfall=2.20"

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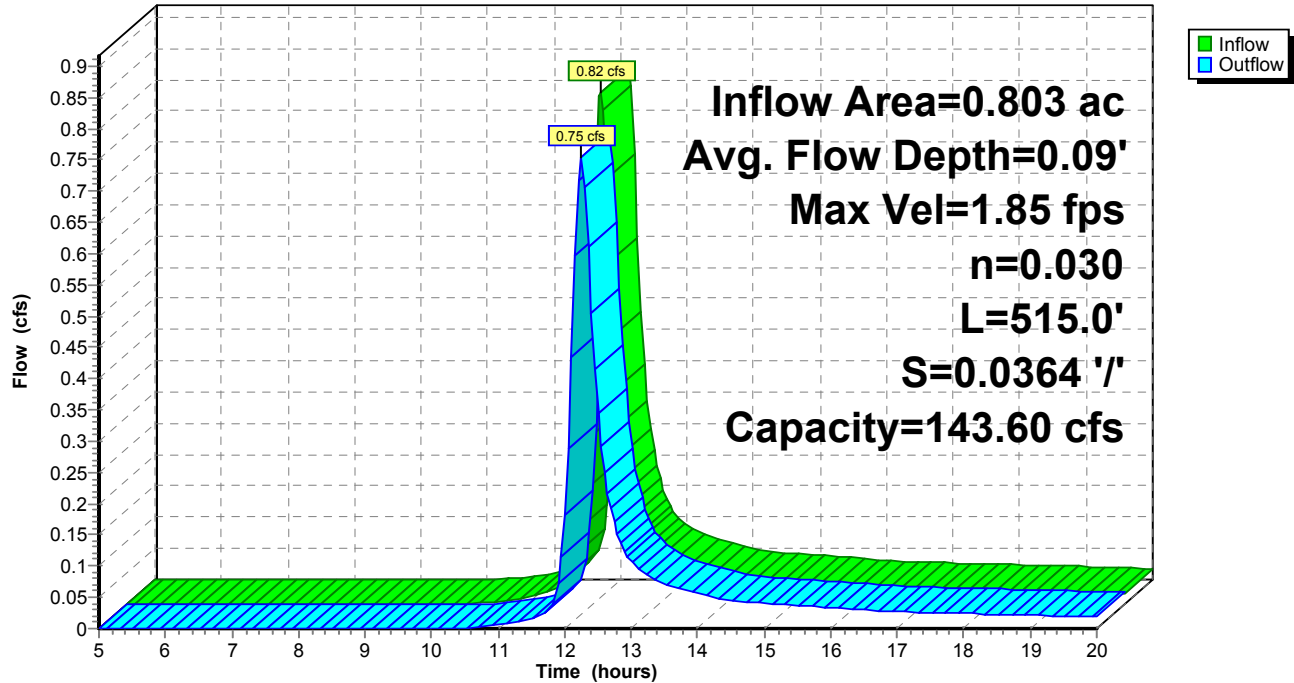
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### Reach 4R: Biofilter

#### Hydrograph



**Deer Run B\_RT2***Type II 24-hr Rainfall=2.20"*Prepared by HydroCAD SAMPLER 1-800-927-7246 [www.hydrocad.net](http://www.hydrocad.net)

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**Hydrograph for Reach 4R: Biofilter**

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Outflow (cfs)
5.00	0.00	0	856.54	0.00
5.50	0.00	0	856.54	0.00
6.00	0.00	0	856.54	0.00
6.50	0.00	0	856.54	0.00
7.00	0.00	0	856.54	0.00
7.50	0.00	0	856.54	0.00
8.00	0.00	0	856.54	0.00
8.50	0.00	0	856.54	0.00
9.00	0.00	0	856.54	0.00
9.50	0.00	0	856.54	0.00
10.00	0.00	0	856.54	0.00
10.50	0.00	1	856.54	0.00
11.00	0.01	6	856.54	0.01
11.50	0.03	16	856.55	0.02
12.00	<b>0.56</b>	<b>132</b>	<b>856.60</b>	<b>0.18</b>
12.50	<b>0.21</b>	<b>109</b>	<b>856.59</b>	<b>0.34</b>
13.00	0.09	59	856.57	0.11
13.50	0.06	46	856.56	0.07
14.00	0.05	39	856.56	0.06
14.50	0.04	36	856.56	0.05
15.00	0.04	34	856.56	0.04
15.50	0.03	32	856.56	0.04
16.00	0.03	29	856.55	0.03
16.50	0.03	26	856.55	0.03
17.00	0.03	24	856.55	0.03
17.50	0.03	23	856.55	0.03
18.00	0.02	22	856.55	0.02
18.50	0.02	20	856.55	0.02
19.00	0.02	19	856.55	0.02
19.50	0.02	18	856.55	0.02
20.00	0.02	16	856.55	0.02

## Appendix D

### Time of Concentration Calculations

Time of Concentration - Pre Conditions Subarea A Right Ditch #1

Overland (Sheet Flow) Time of Concentration

to = 0.04 hr OR 2.66 minutes

t\_o = (0.007(nL)^0.8) / (P\_2^0.5 \* S^0.4)

Where,

n (Manning's roughness coefficient)	0.4
L (Sheet flow Length)	200
P <sub>2</sub> (2yr, 24hr rainfall, inches)	2.63
S (slope of land surface, ft/ft)	0.06

Shallow Time of Concentration

	Depth	Manning's n	Velocity
Flow Type	0.2	0.101	Use Figure 15-4 to determine Velocity
Slope	ft/ft		
Velocity from Chart	ft/s		
Length	ft		
t =	hr	3.33 minutes	

TOTAL TIME OF CONCENTRATION = 0.20 hr OR 12.03 minutes



## Time of Concentration - Post Conditions Subarea A Right Ditch #1

### Overland (Sheet Flow) Time of Concentration

to = 0.01 hr OR 0.88 minutes

$$t_o = \frac{0.007(nL)^{0.8}}{P_2^{0.5} S^{0.4}}$$

Where,

n  
(Manning's roughness coefficient)

L  
(Sheet flow Length)

P<sub>2</sub>  
(2yr, 24hr rainfall, inches)

S  
(slope of land surface, ft/ft)

0.4

50

2.63

0.06

### Shallow Time of Concentration

	Depth	Manning's n	Velocity
Flow Type Minimum tillage cultivation, contour or strip-cropped, and woodlands	0.2	0.101	Use Figure 15-4 to determine Velocity
Slope	0.027 ft/ft		
Velocity from Chart	0.6 ft/s		
Length	255 ft		
t =	0.12 hr	7.08 minutes	

### Open Channel Flow

Calc Check

Area =	0.03	ft <sup>2</sup>	0.03
Radius =	0.01	ft	0.01
Slope(ft/ft) =	0.0876		
n =	0.03		

V (velocity) 0.85 ft/sec

Drainage Area (acres) = 0.73 acres

C (Coefficient of Runoff) = 0.3

I = 0.11

Q = CiA 0.024 cfs

Ditch Width = 2 ft

Foreslope/Backslope = 3

Depth of water in Ditch = 0.17  
\*in inches

Length of Ditch = 300

t<sub>open</sub> = 0.10 hr

**TOTAL TIME OF CONCENTRATION = 0.23 hr OR 13.86 minutes**

Time of Concentration - Pre Conditions Subarea A Right Ditch #1

Overland (Sheet Flow) Time of Concentration

to = 0.04 hr OR 2.66 minutes

t\_o = (0.007(nL)^0.8) / (P\_2^0.5 \* S^0.4)

Where,

n (Manning's roughness coefficient)	0.4
L (Sheet flow Length)	200
P <sub>2</sub> (2yr, 24hr rainfall, inches)	2.63
S (slope of land surface, ft/ft)	0.06

Shallow Time of Concentration

	Depth	Manning's n	Velocity
Flow Type	0.2	0.101	Use Figure 15-4 to determine Velocity
Slope	ft/ft		
Velocity from Chart	ft/s		
Length	ft		
t =	hr	3.33 minutes	

TOTAL TIME OF CONCENTRATION = 0.20 hr OR 12.03 minutes

Time of Concentration - Post Conditions Subarea A Left Ditch #1

Overland (Sheet Flow) Time of Concentration

to = 0.0004 hr OR 0.02 minutes

t\_o = (0.007(nL)^0.8) / (P\_2^0.5 S^0.4)

Where,

n (Manning's roughness coefficient)	0.011
L (Sheet flow Length)	10
P <sub>2</sub> (2yr, 24hr rainfall, inches)	2.63
S (slope of land surface, ft/ft)	0.0156

Open Channel Flow

			Calc Check
Area =	0.01	ft <sup>2</sup>	0.01
Radius =	0.01	ft	0.01
Slope(ft/ft) =	0.0876		
n =	0.03		
V (velocity)	0.52	ft/sec	
Drainage Area (acres) =	0.16	acres	
C (Coefficient of Runoff) =	0.3		
I =	0.11		
Q = CiA	0.005	cfs	
Q = (Check) Q= VA	0.007	cfs	
Ditch Width =	2	ft	Depth of water in Ditch = 0.08
Foreslope/Backslope =	3		*inches
			Length of Ditch = 250
t <sub>open</sub> =			0.13 hr
TOTAL TIME OF CONCENTRATION =			0.13 hr OR 8.08 minutes

Time of Concentration - Pre Conditions Subarea B Left Ditch #1

Overland (Sheet Flow) Time of Concentration

to = 0.03 hr OR 1.51 minutes

to = (0.007(nL)^0.8) / (P2^0.5 \* S^0.4)

Where,

n (Manning's roughness coefficient)	0.4
L (Sheet flow Length)	125
P2 (2yr, 24hr rainfall, inches)	2.63
S (slope of land surface, ft/ft)	0.096

Shallow Time of Concentration

		Depth	Manning's n	Velocity
Flow Type	Minimum tillage cultivation, contour or strip-cropped, and woodlands	0.2	0.101	Use Figure 15-4 to determine Velocity
Slope	0.0267	ft/ft		
Velocity from Chart	0.7	ft/s		
Length	150	ft		
t =	0.06	hr	3.57 minutes	

topen = 0.00 hr

TOTAL TIME OF CONCENTRATION = 0.08 hr OR 5.08 minutes

Time of Concentration - Post Conditions Subarea B Left Ditch #1

Overland (Sheet Flow) Time of Concentration

to = 0.00 hr OR 0.08 minutes

to = (0.007(nL)^0.8) / (P2^0.5 \* S^0.4)

Where,

n (Manning's roughness coefficient)	0.03
L (Sheet flow Length)	16
P2 (2yr, 24hr rainfall, inches)	2.63
S (slope of land surface, ft/ft)	0.0156

Open Channel Flow

Area =	0.02	ft²	Calc Check 0.02
Radius =	0.00	ft	0.00
Slope(ft/ft) =	0.0452		
n =	0.03		

V (velocity) 0.27 ft/sec

Drainage Area (acres) =	0.15	acres
C (Coefficient of Runoff) =	0.3	
I =	0.11	
Q = CiA	0.005	cfs

Ditch Width =	4	ft	Depth of water in Ditch = 0.05 *in inches
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Foreslope/Backslope =	4		Length of Ditch = 165
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topen = 0.17 hr

TOTAL TIME OF CONCENTRATION = 0.17 hr OR 10.16 minutes

Time of Concentration - Pre Conditions Subarea B Left Ditch #2

Overland (Sheet Flow) Time of Concentration

to = 0.03 hr OR 1.51 minutes

to = (0.007(nL)^0.8) / (P2^0.5 \* S^0.4)

Where,

n (Manning's roughness coefficient)	0.4
L (Sheet flow Length)	125
P2 (2yr, 24hr rainfall, inches)	2.63
S (slope of land surface, ft/ft)	0.096

Shallow Time of Concentration

		Depth	Manning's n	Velocity
Flow Type	Minimum tillage cultivation, contour or strip-cropped, and woodlands	0.2	0.101	Use Figure 15-4 to determine Velocity
Slope	0.0267	ft/ft		
Velocity from Chart	0.7	ft/s		
Length	150	ft		
t =	0.06	hr	3.57 minutes	

topen = 0.00 hr

TOTAL TIME OF CONCENTRATION = 0.08 hr OR 5.08 minutes

Time of Concentration - Post Conditions Subarea B Left Ditch #2

Overland (Sheet Flow) Time of Concentration

to = 0.00 hr OR 0.08 minutes

to = (0.007(nL)^0.8) / (P2^0.5 \* S^0.4)

Where,

n (Manning's roughness coefficient)	0.03
L (Sheet flow Length)	16
P2 (2yr, 24hr rainfall, inches)	2.63
S (slope of land surface, ft/ft)	0.0156

Open Channel Flow

Area =	0.03	ft²	Calc Check 0.03
Radius =	0.01	ft	0.01
Slope(ft/ft) =	0.0364		
n =	0.03		

V (velocity) 0.36 ft/sec

Drainage Area (acres) =	0.34	acres
C (Coefficient of Runoff) =	0.3	
I =	0.11	
Q = CiA	0.011	cfs

Ditch Width =	4	ft	Depth of water in Ditch = 0.09 *in inches
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Foreslope/Backslope =	4		Length of Ditch = 430
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topen = 0.33 hr

TOTAL TIME OF CONCENTRATION = 0.33 hr OR 19.92 minutes

Time of Concentration - Pre Conditions Subarea B Right Ditch #1

Overland (Sheet Flow) Time of Concentration

to = 0.03 hr OR 1.51 minutes

t\_o = (0.007(nL)^0.8) / (P\_2^0.5 S^0.4)

Where,

n (Manning's roughness coefficient)	0.4
L (Sheet flow Length)	125
P <sub>2</sub> (2yr, 24hr rainfall, inches)	2.63
S (slope of land surface, ft/ft)	0.096

Shallow Time of Concentration

		Depth	Manning's n	Velocity
Flow Type	Minimum tillage cultivation, contour or strip-cropped, and woodlands	0.2	0.101	Use Figure 15-4 to determine Velocity
Slope	0.0267	ft/ft		
Velocity from Chart	0.7	ft/s		
Length	150	ft		
t =	0.06	hr	3.57 minutes	

t\_open = 0.00 hr

TOTAL TIME OF CONCENTRATION = 0.08 hr OR 5.08 minutes



Time of Concentration - Post Conditions Subarea B Right Ditch #1

Overland (Sheet Flow) Time of Concentration

to = 0.02 hr OR 1.36 minutes

to = (0.007(nL)^0.8) / (P2^0.5 \* S^0.4)

Where,

n (Manning's roughness coefficient)	0.4
L (Sheet flow Length)	50
P2 (2yr, 24hr rainfall, inches)	2.63
S (slope of land surface, ft/ft)	0.02

Open Channel Flow

Area =	0.04	ft²	Calc Check 0.04
Radius =	0.01	ft	0.01
Slope(ft/ft) =	0.0452		
n =	0.03		

V (velocity) 0.51 ft/sec

Drainage Area (acres) =	0.68	acres
C (Coefficient of Runoff) =	0.3	
I =	0.11	
Q = CiA	0.022	cfs

Ditch Width =	4	ft	Depth of water in Ditch = 0.13 *in inches
---------------	---	----	---

Foreslope/Backslope =	4		Length of Ditch = 185 (in feet)
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topen = 0.10 hr

TOTAL TIME OF CONCENTRATION = 0.12 hr OR 7.37 minutes

Time of Concentration - Pre Conditions Subarea B Right Ditch #2

Overland (Sheet Flow) Time of Concentration

to =

0.03 hr

OR  
1.51  
minutes

to

=

0.007(nL)<sup>0.8</sup>

P<sub>2</sub><sup>0.5</sup>

s<sup>0.4</sup>

Where,

n (Manning's roughness coefficient)	0.4
L (Sheet flow Length)	125
P <sub>2</sub> (2yr, 24hr rainfall, inches)	2.63
S (slope of land surface, ft/ft)	0.096

Shallow Time of Concentration

		Depth	Manning's n	Velocity
Flow Type	Minimum tillage cultivation, contour or strip-cropped, and woodlands	0.2	0.101	Use Figure 15-4 to determine Velocity
Slope	0.0267	ft/ft		
Velocity from Chart	0.7	ft/s		
Length	150	ft		
t =	0.06	hr	3.57 minutes	

t<sub>open</sub> =

0.00 hr

TOTAL TIME OF  
CONCENTRATION =

0.08 hr  
OR  
5.08 minutes

Time of Concentration - Post Conditions Subarea B Right Ditch #2

Overland (Sheet Flow) Time of Concentration

to = 0.02 hr OR 1.36 minutes

to = (0.007(nL)^0.8) / (P2^0.5 \* S^0.4)

Where,

n (Manning's roughness coefficient)	0.4
L (Sheet flow Length)	50
P2 (2yr, 24hr rainfall, inches)	2.63
S (slope of land surface, ft/ft)	0.02

Open Channel Flow

Area =	0.05	ft <sup>2</sup>	Calc Check 0.05
Radius =	0.01	ft	0.01
Slope(ft/ft) =	0.0364		
n =	0.03		

V (velocity)	0.51	ft/sec
Drainage Area (acres) =	0.79	acres
C (Coefficient of Runoff) =	0.3	
I =	0.11	
Q = CiA	0.026	cfs
Ditch Width =	4	ft
Foreslope/Backslope =	4	

Depth of water in Ditch = 0.15  
\*in inches

Length of Ditch = 510

topen = 0.28 hr

TOTAL TIME OF CONCENTRATION = 0.30 hr OR 18.16 minutes

## Appendix E

### Exhibits







